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PRESSURE DISTRIBUTIONS ON 140°, 160°, AND 180° CONES AT MACH NUMBERS FROM 2.30 TO 4.63 AND ANGLES OF ATTACK FROM 0° TO 20°

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SUMMARY

An experimental investigation has been conducted to obtain surface-pressure distributions on spherically blunted cones with apex angles of 140°, 160°, and 180° (flat disk). The 140° and 160° cones had a ratio of nose radius to base radius of 0.25. The studies were conducted at Mach numbers from 2.30 to 4.63 and at angles of attack from 0° to 20°.

Results of this study indicated that an increase in cone angle or angle of attack or both leads to an increase in pressure windward of the measured stagnation point; a decrease in cone angle or an increase in angle of attack leads to a decrease in pressure leeward of the measured stagnation point. Mach number has little effect on the pressure distributions for the cones at zero angle of attack. At angles of attack greater than zero, an increase in Mach number results in a decrease in pressure on the leeward side of all the configurations. A correlation parameter successfully correlates the stagnation-point locations for the entire range of test Mach number, cone angle, and angle of attack; an empirical representation of this correlation is in good agreement with the experimental results. Pressure distributions obtained on the cone models at zero angle of attack are in good agreement with a theoretical solution based on the one-strip method of integral relations. Circumferential pressure distributions on large-angle conical bodies are amenable to approximation by second-order polynomials.

INTRODUCTION

Vehicles with low ballistic coefficients (i.e., high aerodynamic drag) are being considered for use as unmanned probes to traverse planetary atmospheres. The function of this type of vehicle is to protect the payload from the severe loading and heating environments associated with entry while providing sufficient aerodynamic deceleration. One particular body shape which appears to be amenable to this type of mission is the large-angle cone (ref. 1). Optimization of the conical shape for a particular mission profile is dependent on an adequate knowledge of local flow properties, local aerodynamic heating

rates, and local structural loading. These criteria can be determined from surface-pressure distributions. The experimental investigations of references 2 and 3 provide pressure distributions on a 120° cone. For the purpose of optimization, the acquisition of similar pressure data on cones with larger apex angles is desirable.

The present investigation was undertaken to obtain surface-pressure distributions on 140°, 160°, and 180° cone configurations. The 140° and 160° cones had a ratio of nose radius to base radius of 0.25; the 180° cone was a flat disk. The data were obtained at Mach numbers from 2.30 to 4.63 and at angles of attack from 0° to 20°. Reynolds number for these studies was 2.0×10^6 based on model (base) diameter.

SYMBOLS

A,B,C	constants (see eq. (3))
C_p	pressure coefficient, $\frac{p_l - p_\infty}{q_\infty}$
D	base diameter
M_l	local Mach number
M_∞	free-stream Mach number
p_L	local static pressure along leeward ray ($\theta = 0^{\circ}$) for $\alpha > 0^{\circ}$
p_l	local static pressure
p_t	free-stream stagnation pressure
$p_{t,2}$	stagnation pressure behind a normal shock
p_W	local static pressure along windward ray ($\theta = 180^{\circ}$) for $\alpha > 0^{\circ}$
p_∞	free-stream static pressure
q_∞	free-stream dynamic pressure
r_b	base radius
r_n	nose radius

s surface length (see fig. 1)

s^* total surface length (i.e., surface length from most forward station on model to shoulder corner) (see fig. 1)

$(s/s^*)_{sp}$ stagnation-point location

α angle of attack

β nondimensionalized parameter used to correlate stagnation-point location, $\frac{\alpha}{120^\circ - \sigma_c}$ (see eq. (8))

γ ratio of specific heats

θ meridian angle

σ_c cone semiapex angle

ϕ roll angle

APPARATUS AND TESTS

Wind Tunnel

Studies were performed in the high Mach number test section of the Langley Unitary Plan wind tunnel, which is a variable-pressure continuous-flow facility. The test section is approximately 4 feet (1.22 meters) square and 7 feet (2.13 meters) long. The nozzle leading to the test section is of the asymmetric sliding-block type, which permits a continuous variation in the test-section Mach number from about 2.30 to 4.63.

Models and Instrumentation

Details of the cone models with apex angles of 140°, 160°, and 180° are presented in figure 1. The models were constructed of polished aluminum and had sharp shoulders. The 140° and 160° cone models had spherically blunted noses, the radii of which were 25 percent of the magnitude of the base radii. Some amount of thickness was necessary for the 180° cone (flat disk) to facilitate the installation of the pressure orifices. A sharp shoulder was produced in the 180° cone by the 15° bevel illustrated in figure 1(b). Base diameter of all the models was 8.00 inches (20.32 cm), and the sting utilized for the studies had a diameter of 1.50 inches (3.81 cm). The surfaces of the 140° and 160° cone

models were instrumented with 49 pressure orifices, whereas the 180° cone model was instrumented with 45 pressure orifices. (See fig. 1.) Internal diameter for the pressure orifices was 0.050 inch (0.127 cm). The orifices were located along the meridians $\theta = 0^\circ$, 90°, 180°, and 270°.

The pressures were recorded by using two 48-channel pressure-sampling valves which sequentially transmit each pressure sampling to an electrical pressure transducer. The transducer transforms the pressure information into an electrical signal which is then recorded in digital form on punch cards. The two gages had a maximum range of 10.0 psia (6.89 N/cm^2).

Accuracy and Test Conditions

The accuracy of the pressure-sampling values is within 1 percent of the full-scale range of the gage; this accuracy includes all errors of linearity, hysteresis, and repeatability. The stagnation pressure was measured with a precision mercury manometer, the accuracy of which is ±0.5 psf (±23.94 N/m^2). The models were tested at free-stream Mach numbers of 2.30, 2.96, 3.95, and 4.63 for a Reynolds number of 2.0×10^6 based on model (base) diameter. The results of a test-section calibration indicated the following deviations in Mach number:

For $M_\infty = 2.30$	±0.02
For $M_\infty = 2.96$	±0.02
For $M_\infty = 3.95$	±0.06
For $M_\infty = 4.63$	±0.05

Tunnel stagnation temperatures were 150° F (338.7° K) at $M_\infty = 2.30$ and 2.96 and 175° F (352.6° K) at $M_\infty = 3.95$ and 4.63. Pressure data were obtained for the models at angles of attack from 0° to 20° for a zero sideslip condition. Circumferential pressure distributions were obtained by rolling the model from 0° to 90° at constant angles of attack. Boundary-layer trips were not affixed to the models and base pressure measurements were not made.

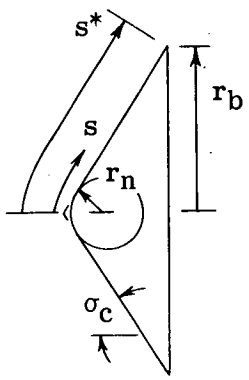
TABULATION OF EXPERIMENTAL DATA

The experimental pressure data obtained during the course of this investigation are presented in tables I to XII. Listed along with the measured static pressures are the pressure coefficients and Mach numbers. The values of $p_l/p_{t,2}$ and M_l are based on the computed stagnation pressure behind a normal shock, which was obtained from normal-shock relations, together with free-stream Mach number and stagnation pressure. The isentropic flow equation used to calculate M_l is

$$M_l = \sqrt{\frac{2}{\gamma - 1}\left[\left(\frac{p_l}{p_{t,2}}\right)^{\frac{-\gamma-1}{\gamma}} - 1\right]} \tag{1}$$

where the value γ was taken to be 1.4.

Each pressure listed in the tables is identified by an orifice number (as defined in fig. 1) and the associated meridian angle and surface length. Surface length is presented nondimensionalized by both the base diameter D and the total surface length s^*. For the spherically blunted cone, as illustrated in the sketch, the total surface length is found to be



$$s^* = r_n(90^\circ - \sigma_c) + \csc \sigma_c (r_b - r_n \cos \sigma_c) \tag{2}$$

An index to the tabular data is as follows:

Model	M_∞	Table (*)
140° cone	2.30	I
	2.96	II
	3.95	III
	4.63	IV
160° cone	2.30	V
	2.96	VI
	3.95	VII
	4.63	VIII
180° cone (flat disk)	2.30	IX
	2.96	X
	3.95	XI
	4.63	XII

*Each table is divided into five parts with part (a) being for $\alpha = 0^\circ$, part (b) for $\alpha = 5^\circ$, part (c) for $\alpha = 10^\circ$, part (d) for $\alpha = 15^\circ$, and part (e) for $\alpha = 20^\circ$.

It should be noted that the data for orifice 29 on the 140° cone were incorrect because of leakage and are not presented in the tables.

RESULTS AND DISCUSSION

The discussion presented herein is limited to the effects of cone angle, angle of attack, and free-stream Mach number on the variation of local static pressure.

Experimental Pressure Distributions

The effect of cone angle on the pressure distributions can be seen in figure 2, in which the local static pressures, nondimensionalized by stagnation pressure behind a normal shock, are plotted as a function of local surface length, nondimensionalized by total surface length. These results are presented for a free-stream Mach number of 2.96 and for angles of attack of 0°, 10°, and 20° and are typical of those results obtained at the other test Mach numbers. Experimental data for a 120° cone (ref. 2), having the same percentage of nose bluntness as the 140° and 160° cone models of the present investigation, are included for comparison.

As shown in figure 2, at zero angle of attack, an increase in cone angle results in an increase in pressure over the entire face of the cone, and the stagnation point (indicated by the maximum measured pressure) is located, as expected, at the apex of the cones regardless of cone angle. At an angle of attack of 10°, the stagnation point shifts to the windward side of the cones, and the pressures in the direction of the windward shoulder become noticeably greater than those for the $\alpha = 0^{\circ}$ condition. Further increase in angle of attack accentuates this shift in stagnation-point location and increase in pressure. Similarly, for angles of attack greater than 0°, an increase in cone angle leads to a further shift in stagnation-point location toward the windward shoulder. Increasing cone angle also results in increases in the pressures located between the stagnation point and the windward shoulder; however, the greatest pressure increase for an increase in cone angle occurs at zero angle of attack.

For the cones at an angle of attack greater than 0°, the expanded flow around the spherical nose results in decreases in pressure from the maximum value at the stagnation point; this decrease in pressure toward the leeward side becomes more significant with decrease in cone angle and increase in angle of attack. The data indicate the existence of an adverse pressure gradient near the sphere-cone juncture on the leeward sides of the 120° cone at $\alpha = 10^{\circ}$ and the 120° and 140° cones at $\alpha = 20^{\circ}$. Increasing cone angle from 120° decreases the strength of the expansion and adverse pressure gradient, so that a uniform pressure distribution exists on the flat disk (180° cone).

The experimental results presented in figure 2 for the models at $\alpha = 0^{\circ}$ and $M_{\infty} = 2.96$ are compared in figure 3 with the results from the one-strip method of integral relations described in reference 4. The pressures predicted by the integral-relations method are in good agreement with the experimental values for all the cone models. A maximum deviation in agreement occurs at a value of s/s^* of about 0.8, where the theoretical predictions are approximately 3 percent less than the experimental values.

The effect of angle of attack on the pressure distributions of the three cone models is more clearly illustrated in figures 4 to 6 for all the test Mach numbers. The curves faired through the pressure data are extrapolated to the sonic condition which theoretically exists at the shoulder. As previously indicated, an increase in angle of attack results in higher pressures on the windward side and lower pressures on the leeward side. A progressive shift in the stagnation point toward the windward shoulder is noted as angle of attack is increased to the highest test value. The adverse pressure gradient located near the sphere-cone juncture on the leeward side of the 140° cone (mentioned previously) is seen in figure 4 to increase with increased angle of attack. Similar trends in pressure distribution exist for the 160° cone, as shown in figure 5, though to a lesser degree than exist for the 140° cone. Increasing cone angle and decreasing angle of attack have similar effects on the pressure distributions on the leeward side of the models; increasing cone angle and increasing angle of attack have similar effects on the pressure distributions on the windward side.

The data presented in figures 7 to 9 illustrate the effect of free-stream Mach number on the pressure distributions for the cone models at angles of attack of 0°, 10°, and 20°. At $\alpha = 0^{\circ}$, only small effects of Mach number are seen for the different cone configurations. The small differences in pressure between the 0° and 180° meridians noted at the highest test Mach numbers are probably due to slight data acquisition inaccuracies. At angles of attack greater than 0°, the pressures windward of the stagnation point are relatively insensitive to increase in Mach number, whereas the pressures leeward of the stagnation point decrease with increased Mach number. This decrease in pressure is particularly obvious near the sphere-cone juncture. An increase in angle of attack increases this Mach number effect.

Pressures obtained by rolling the cone models from 0° to 90° at a constant angle of attack are presented in figures 10 to 12 for $M_{\infty} = 2.96$. Data shown for $0^{\circ} \leqq \theta \leqq 90^{\circ}$ were actually obtained in the quadrant $270^{\circ} \leqq \theta \leqq 360^{\circ}$, but since the flow is symmetrical about the plane of symmetry, they are presented as a continuous variation of θ from 0° to 180°. For each s/D station for which circumferential pressure distributions are shown, local pressure is nondimensionalized by the pressure along the windward meridian ($\theta = 180^{\circ}$). Plotted in this form, the circumferential pressures show progressively

larger variations from the windward meridian ($\theta = 180^{\circ}$) to the leeward meridian ($\theta = 0^{\circ}$) at increased distances from the nose or at larger angles of attack or both.

Analytical Pressure Distributions

Attempts have been made by several investigators to curve-fit the type of circumferential pressure distributions plotted in figures 10 to 12 by using a second-order polynomial of the form

$$\frac{p_l}{p_W} = A \cos^2\theta + B \cos\theta + C \tag{3}$$

In particular, reference 2 has shown that equation (3) provides good agreement with experimental pressures obtained on a 120° cone if the following conditions are met:

At $\theta = 0^{\circ}$,

$$\frac{p_l}{p_W} = \frac{p_L}{p_W}$$

at $\theta = 180^{\circ}$,

$$\frac{p_l}{p_W} = 1$$

and at $\theta = 0^{\circ}$,

$$\frac{d^2}{d\theta^2}\left(\frac{p_l}{p_W}\right) = 0$$

By using these conditions, equation (3) becomes

$$\frac{p_l}{p_W} = \frac{1}{4}\left(1 - \frac{p_L}{p_W}\right)\left(\cos^2\theta - 2\cos\theta - 3\right) + 1 \tag{4}$$

The circumferential pressure distributions predicted by this expression for the 120° cone are seen in figures 10 to 12 to provide good agreement with the measured values of the 140°, 160°, and 180° cone data; however, some degradation of agreement is noted with increased cone angle. The circumferential pressure distributions on a flat disk also have been approximated by the following empirical expression, which was derived by Robert L. Stallings, Jr., of the Langley Research Center:

$$\frac{p_l}{p_W} = \left(1 - \frac{p_L}{p_W}\right)\left(0.072\cos^2\theta - 0.500\cos\theta + 0.428\right) + \frac{p_L}{p_W} \tag{5}$$

The curves derived from this expression are presented in figure 12 and are seen generally to provide a better estimation of the circumferential pressure distributions on the flat disk than the curves given by equation (4).

The extent to which the circumferential pressure distributions for the three cone models deviate from those predicted by equations (4) and (5) can be found by separating the variables of these equations. Equation (4) becomes

$$\frac{p_W - p_l}{p_W - p_L} = \frac{1}{4}\left(-\cos^2\theta + 2\cos\theta + 3\right) \tag{6}$$

and equation (5) becomes

$$\frac{p_W - p_l}{p_W - p_L} = 1 - \left(0.072\cos^2\theta - 0.500\cos\theta + 0.428\right) \tag{7}$$

Curves obtained from these expressions are presented in figure 13 along with experimental results obtained from figures 10 to 12 for the three cone models. It should be noted that the experimental results shown are averaged values obtained from the various conditions of s/D and α in figures 10 to 12 for which the curve fits were attempted. As can be seen, good agreement exists between the experimental circumferential pressures obtained for the 140° cone and those estimated by equation (6), whereas increasing cone angle results in greater disagreement between this expression and the experimental data. The circumferential pressure distribution generated by equation (7) agrees well with that obtained experimentally on the flat disk. These results indicate that circumferential pressure distributions on large-angle conical bodies are amenable to approximation by second-order polynomials.

The experimental data presented in figures 2 to 9 have indicated that the movement of the stagnation point along the windward meridian is dependent primarily on cone angle and angle of attack. An attempt was made to correlate the stagnation-point locations for the cone configurations of this investigation and of reference 2 by using a correlating parameter similar to that suggested in reference 2. Experimental stagnation-point location $(s/s^*)_{sp}$ is shown in figure 14 as a function of the nondimensionalized parameter $\frac{\alpha}{120^\circ - \sigma_c} = \beta$. By using these experimental data, an empirical expression was generated by the method of least squares resulting in the following third-order polynomial equation:

$$\left(\frac{s}{s^*}\right)_{sp} = -4.210\beta^3 + 3.825\beta^2 + 0.432\beta \tag{8}$$

As can be seen in figure 14, this expression yields a smooth variation in $(s/s^*)_{sp}$ with β. The maximum deviation between the experimental data and empirical curve is within

about 0.1 of $(s/s^*)_{sp}$ for the entire range of cone angle, angle of attack, and Mach number.

CONCLUDING REMARKS

Local flow properties have been experimentally obtained from surface-pressure distributions on spherically blunted cones with apex angles of 140^o, 160^o, and 180^o. The 140^o and 160^o cones had a ratio of nose radius to base radius of 0.25; the 180^o cone was a flat disk. The studies were conducted at Mach numbers from 2.30 to 4.63 and at angles of attack from 0^o to 20^o. Analysis of the results was limited to variations in local static pressure and indicated the following concluding remarks:

1. An increase in cone angle or angle of attack or both leads to an increase in pressure windward of the measured stagnation point; a decrease in cone angle or an increase in angle of attack leads to a decrease in pressure leeward of the measured stagnation point.

2. Mach number has little effect on the pressure distributions for the cones at zero angle of attack. At angles of attack greater than zero, an increase in Mach number results in a decrease in pressure on the leeward side of all the configurations.

3. A correlation parameter successfully correlates the stagnation-point locations for the entire range of test Mach number, cone angle, and angle of attack; an empirical representation of this correlation is in good agreement with the experimental results.

4. Pressure distributions obtained on the cone models at zero angle of attack are in good agreement with a theoretical solution based on the one-strip method of integral relations.

5. Circumferential pressure distributions on large-angle conical bodies are amenable to approximation by second-order polynomials.

Langley Research Center,
National Aeronautics and Space Administration,
Langley Station, Hampton, Va., February 18, 1969,
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TABLE I.- DATA[a] FOR 140° CONE; $M_\infty = 2.30$

(a) $\alpha = 0°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 2292.0 psf					Φ = 22.5°, p_t = 2291.0 psf					Φ = 45.0°, p_t = 2291.6 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1332.0	1.692	.99631	7.26685	.37267	1333.5	1.695	.99785	7.27810	.05540	1333.5	1.695	.99759	7.27619	.05868
2	0	.230	.025	.0471	1327.2	1.685	.99273	7.24071	.10216	1327.1	1.686	.99307	7.24319	.09973	1328.7	1.688	.99400	7.25002	.09272
3	0	.430	.050	.0943	1320.8	1.676	.98795	7.20586	.13172	1320.7	1.677	.98828	7.20829	.12987	1322.3	1.678	.98922	7.21512	.12453
4	0	.630	.075	.1414	1312.8	1.664	.98198	7.16229	.16140	1314.3	1.667	.98350	7.17338	.15437	1314.3	1.667	.98324	7.17150	.15558
5	0	.830	.100	.1886	1304.8	1.652	.97630	7.11873	.18660	1307.9	1.658	.97871	7.13847	.17560	1307.9	1.657	.97845	7.13660	.17667
6	0	1.030	.125	.2357	1298.5	1.643	.97123	7.08387	.20465	1299.9	1.646	.97273	7.09484	.19914	1299.9	1.645	.97247	7.09298	.20008
7	0	1.230	.150	.2829	1292.1	1.634	.96665	7.04902	.22135	1290.3	1.632	.96555	7.04248	.22435	1290.3	1.631	.96530	7.04063	.22519
8	0	1.430	.175	.3300	1284.1	1.622	.96047	7.00545	.24077	1282.3	1.620	.95957	6.99884	.24354	1282.3	1.620	.95932	6.99701	.24431
9	0	1.630	.200	.3772	1272.9	1.605	.95211	6.94446	.26570	1272.7	1.606	.95239	6.94648	.26491	1272.7	1.605	.95214	6.94467	.26562
10	0	1.830	.225	.4243	1263.3	1.591	.94494	6.89218	.28558	1263.1	1.592	.94521	6.89412	.28497	1263.1	1.591	.94496	6.89232	.28553
11	0	2.030	.250	.4715	1252.1	1.575	.93658	6.83119	.30739	1251.9	1.575	.93683	6.83304	.30673	1251.9	1.575	.93659	6.83125	.30736
12	0	2.230	.275	.5186	1241.0	1.558	.92822	6.77020	.32795	1239.1	1.556	.92726	6.76322	.33024	1240.7	1.558	.92822	6.77018	.32796
13	0	2.430	.300	.5658	1228.2	1.539	.91856	6.70049	.35025	1227.9	1.540	.91889	6.70214	.34974	1227.9	1.539	.91865	6.70038	.35029
14	0	2.630	.325	.6129	1217.0	1.523	.91030	6.63950	.36889	1215.2	1.521	.90932	6.63232	.37103	1213.6	1.518	.90788	6.62186	.37414
15	0	2.830	.350	.6601	1201.0	1.499	.89835	6.55236	.39433	1199.2	1.497	.89735	6.54505	.39641	1199.2	1.497	.89712	6.54334	.39690
16	0	3.030	.375	.7072	1181.9	1.471	.88402	6.44781	.42338	1180.0	1.469	.88299	6.44033	.42543	1181.6	1.471	.88396	6.44737	.42350
17	0	3.230	.400	.7544	1161.1	1.441	.86849	6.33453	.45337	1160.8	1.441	.86864	6.33561	.45309	1159.2	1.438	.86721	6.32523	.45577
18	0	3.430	.425	.8015	1137.1	1.405	.85057	6.20383	.48646	1135.8	1.406	.85069	6.20471	.48624	1135.2	1.403	.84327	6.19436	.48880
19	0	3.630	.450	.8487	1105.8	1.361	.82787	6.03828	.52656	1104.8	1.358	.82676	6.03018	.52848	1104.8	1.358	.82654	6.02860	.52886
20	0	3.830	.475	.8958	1063.7	1.297	.79562	5.80302	.58097	1063.3	1.297	.79565	5.80328	.58092	1063.3	1.297	.79544	5.80176	.58126
21	0	4.030	.500	.9430	998.2	1.201	.74664	5.44578	.65978	997.7	1.201	.74660	5.44549	.65985	996.1	1.198	.74520	5.43533	.66204
22	180	.230	.025	.0471	1331.9	1.692	.99622	7.26620	.37354	1333.5	1.695	.99785	7.27810	.05540	1333.5	1.695	.99759	7.27619	.05868
23	180	.430	.050	.0943	1325.5	1.683	.99144	7.23131	.11089	1325.5	1.684	.99187	7.23447	.10804	1327.1	1.685	.99281	7.24130	.10159
24	180	.630	.075	.1414	1319.1	1.673	.98666	7.19642	.13867	1319.1	1.674	.98709	7.19956	.13639	1319.1	1.674	.98683	7.19767	.13776
25	180	.830	.100	.1886	1311.1	1.662	.98068	7.15280	.16719	1312.7	1.665	.98230	7.16465	.15993	1312.7	1.664	.98204	7.16278	.16110
26	180	1.030	.125	.2357	1304.7	1.652	.97589	7.11791	.18704	1304.7	1.653	.97632	7.12102	.18535	1303.1	1.650	.97687	7.11043	.19104
27	180	1.230	.150	.2829	1295.7	1.640	.96991	7.07430	.20936	1295.1	1.639	.96914	7.06866	.21209	1295.1	1.638	.96889	7.06681	.21298
28	180	1.430	.175	.3300	1288.7	1.629	.96393	7.03068	.22968	1287.1	1.627	.96316	7.02502	.23220	1285.5	1.624	.96171	7.01446	.23683
30	180	1.830	.225	.4243	1269.5	1.600	.94958	6.92601	.27288	1267.9	1.599	.94880	6.92030	.27504	1267.9	1.598	.94855	6.91849	.27573
31	180	2.030	.250	.4715	1259.9	1.586	.94241	6.87367	.29234	1256.7	1.582	.94042	6.85922	.29753	1255.7	1.582	.94018	6.85742	.29817
32	180	2.230	.275	.5186	1247.1	1.567	.93294	6.80389	.31672	1245.5	1.566	.93205	6.79813	.31866	1245.5	1.565	.93180	6.79635	.31926
33	180	2.430	.300	.5658	1235.9	1.551	.92447	6.74283	.33685	1234.3	1.549	.92367	6.73704	.33870	1232.7	1.546	.92224	6.72655	.34205
34	180	2.630	.325	.6129	1221.6	1.530	.91370	6.66432	.36139	1218.4	1.526	.91171	6.64978	.36580	1218.4	1.525	.91147	6.64803	.36632
35	180	2.830	.350	.6601	1205.6	1.506	.90174	6.57709	.38724	1204.0	1.505	.90094	6.57123	.38893	1202.4	1.502	.89951	6.56079	.39193
36	180	3.030	.375	.7072	1188.0	1.480	.88859	6.48114	.41428	1185.4	1.479	.88778	6.47524	.41590	1186.4	1.478	.88755	6.47355	.41636
37	180	3.230	.400	.7544	1167.2	1.450	.87304	6.36774	.44472	1165.6	1.448	.87223	6.36179	.44627	1164.0	1.445	.87080	6.35140	.44899
38	180	3.430	.425	.8015	1143.2	1.414	.85510	6.23690	.47822	1141.6	1.413	.85428	6.23089	.47973	1143.0	1.410	.85286	6.22054	.48231
39	180	3.630	.450	.8487	1114.4	1.372	.83357	6.07988	.51665	1111.2	1.368	.83155	6.06508	.52019	1109.6	1.365	.83013	6.05477	.52265
40	180	3.830	.475	.8958	1072.9	1.311	.80248	5.85309	.56960	1071.3	1.309	.80163	5.84692	.57101	1071.3	1.309	.80142	5.84538	.57136
41	180	4.000	.500	.9430	1007.3	1.214	.75345	5.49545	.64902	1005.7	1.212	.75258	5.48912	.65040	1005.7	1.212	.75238	5.49768	.65071
42	270	1.030	.125	.2357	1303.1	1.650	.97470	7.10919	.19170	1304.7	1.653	.97632	7.12102	.18535	1306.7	1.652	.97606	7.11915	.18637
43	270	2.230	.250	.4715	1258.3	1.584	.94121	6.86495	.29548	1258.3	1.585	.94162	6.86794	.29441	1258.3	1.584	.94137	6.86615	.29505
44	270	3.230	.375	.7072	1189.6	1.483	.88978	6.48986	.41187	1191.2	1.486	.89137	6.50142	.40867	1189.6	1.483	.88994	6.49099	.41156
45	270	4.030	.500	.9430	1012.1	1.221	.75703	5.52162	.64333	1015.3	1.226	.75976	5.54148	.63900	1012.1	1.221	.75717	5.52258	.64312
46	90	1.030	.125	.2357	1300.1	1.645	.97242	7.09259	.20028	1299.9	1.646	.97273	7.09484	.19914	1293.3	1.643	.97128	7.08426	.20447
47	90	2.230	.250	.4715	1252.1	1.575	.93558	6.83119	.30738	1253.3	1.573	.93564	6.82431	.30975	1250.3	1.572	.93539	6.82252	.31037
48	90	3.230	.375	.7072	1181.9	1.471	.88402	6.44781	.42338	1181.6	1.472	.88419	6.44906	.42304	1180.0	1.469	.88276	6.43865	.42586
49	90	4.030	.500	.9430	1001.4	1.205	.74903	5.46321	.65601	1000.9	1.205	.74899	5.46294	.65607	1000.9	1.205	.74879	5.46151	.65638

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE I.- DATA[a] FOR 140° CONE; $M_\infty = 2.30$ - Continued

(a) $\alpha = 0°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 2291.7 psf					Φ = 90.0°, p_t = 2291.5 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1331.9	1.692	.99637	7.26730	.07206	1335.1	1.697	.99885	7.28536	.04055
2	0	.230	.025	.0471	1328.7	1.688	.99398	7.24987	.09289	1333.3	1.690	.99527	7.25922	.08237
3	0	.430	.050	.0943	1322.3	1.678	.98921	7.21501	.12462	1323.9	1.681	.99049	7.22436	.11694
4	0	.600	.075	.1414	1314.3	1.667	.98323	7.17145	.15562	1314.3	1.667	.98332	7.17207	.15521
5	0	.830	.100	.1886	1306.3	1.655	.97726	7.12788	.18158	1309.5	1.660	.97973	7.14593	.17128
6	0	1.030	.125	.2357	1298.4	1.643	.97128	7.08431	.20444	1301.6	1.648	.97376	7.10235	.19527
7	0	1.230	.150	.2829	1290.4	1.631	.96531	7.04074	.22514	1292.0	1.634	.96659	7.05007	.22086
8	0	1.430	.175	.3300	1284.0	1.622	.96053	7.00588	.24053	1284.0	1.622	.96062	7.00649	.24027
9	0	1.630	.200	.3772	1271.2	1.603	.95098	6.93617	.26894	1272.8	1.606	.95225	6.94549	.26530
10	0	1.830	.225	.4243	1263.2	1.591	.94500	6.89260	.28543	1263.2	1.591	.94508	6.89321	.28521
11	0	2.030	.250	.4715	1250.5	1.572	.93544	6.82289	.31024	1250.5	1.573	.93553	6.82349	.31004
12	0	2.230	.275	.5186	1240.9	1.558	.92828	6.77061	.32781	1240.9	1.559	.92836	6.77120	.32762
13	0	2.400	.300	.5658	1228.1	1.540	.91872	6.70090	.35012	1228.1	1.540	.91880	6.70149	.34994
14	0	2.630	.325	.6129	1213.7	1.518	.90797	6.62248	.37396	1216.9	1.523	.91044	6.64048	.36859
15	0	2.800	.350	.6601	1199.3	1.497	.89721	6.54405	.39670	1199.3	1.497	.89729	6.54462	.39654
16	0	3.000	.375	.7072	1180.2	1.469	.88288	6.43949	.42563	1181.8	1.471	.88415	6.44876	.42312
17	0	3.230	.400	.7544	1159.4	1.438	.86735	6.32621	.45552	1162.6	1.443	.86981	6.34419	.45086
18	0	3.430	.425	.8015	1135.5	1.403	.84943	6.19550	.48952	1138.7	1.408	.85189	6.21347	.48407
19	0	3.600	.450	.8487	1105.1	1.358	.82673	6.02994	.52854	1106.7	1.361	.82799	6.03918	.52535
20	0	3.830	.475	.8958	1062.0	1.295	.79447	5.79467	.58286	1063.6	1.297	.79573	5.80389	.58078
21	0	4.030	.500	.9430	998.1	1.201	.74668	5.44612	.65971	999.7	1.203	.74794	5.45531	.65772
22	180	.200	.025	.0471	1333.5	1.695	.99757	7.27601	.05899	1335.0	1.697	.99876	7.28473	.04204
23	180	.430	.050	.0943	1325.5	1.683	.99159	7.23244	.10988	1327.0	1.685	.99278	7.24111	.10177
24	180	.630	.075	.1414	1317.5	1.671	.98562	7.18887	.14399	1319.0	1.674	.98680	7.19749	.13790
25	180	.830	.100	.1886	1309.5	1.660	.97965	7.14530	.17164	1312.6	1.664	.98202	7.16259	.16121
26	180	1.030	.125	.2357	1301.6	1.648	.97367	7.10173	.19560	1303.0	1.650	.97484	7.11025	.19114
27	180	1.230	.150	.2829	1293.6	1.636	.96770	7.05817	.21708	1293.4	1.636	.96766	7.05790	.21721
28	180	1.430	.175	.3300	1285.6	1.624	.96173	7.01460	.23677	1283.8	1.622	.96049	7.00556	.24068
30	180	1.830	.225	.4243	1266.4	1.596	.94739	6.91003	.27893	1266.2	1.596	.94733	6.90959	.27910
31	180	2.030	.250	.4715	1255.2	1.580	.93903	6.84904	.30114	1255.0	1.579	.93896	6.84852	.30132
32	180	2.230	.275	.5186	1244.1	1.563	.93067	6.78804	.32206	1245.4	1.565	.93178	6.79617	.31932
33	180	2.430	.300	.5658	1232.9	1.547	.92230	6.72704	.34189	1232.7	1.546	.92221	6.72638	.34210
34	180	2.630	.325	.6129	1218.5	1.525	.91155	6.64862	.36615	1218.3	1.525	.91145	6.64786	.36637
35	180	2.800	.350	.6601	1204.1	1.504	.90080	6.57019	.38923	1203.9	1.504	.90068	6.56934	.38947
36	180	3.000	.375	.7072	1185.0	1.476	.88646	6.46563	.41853	1186.3	1.478	.88752	6.47338	.41641
37	180	3.200	.400	.7544	1165.8	1.448	.87213	6.36106	.44646	1165.5	1.447	.87197	6.35996	.44675
38	180	3.400	.425	.8015	1141.9	1.412	.85421	6.23036	.47986	1141.5	1.412	.85403	6.22910	.48017
39	180	3.600	.450	.8487	1111.5	1.368	.83151	6.06479	.52026	1111.2	1.367	.83131	6.06334	.52060
40	180	3.830	.475	.8958	1073.2	1.311	.80283	5.85566	.54901	1072.8	1.311	.80260	5.85396	.56940
41	180	4.030	.500	.9430	1007.7	1.215	.75385	5.49840	.64838	1007.2	1.214	.75356	5.49626	.64885
42	270	1.030	.125	.2357	1304.8	1.652	.97636	7.11916	.18636	1307.8	1.657	.97843	7.13642	.17677
43	270	2.030	.250	.4715	1260.0	1.587	.94261	6.87518	.29180	1261.4	1.589	.94374	6.88342	.28880
44	270	3.030	.375	.7072	1189.8	1.483	.89005	6.49177	.41134	1189.5	1.483	.88992	6.49083	.41160
45	270	4.030	.500	.9430	1012.5	1.222	.75743	5.52454	.64270	1013.6	1.224	.75834	5.53116	.64125
46	90	1.030	.125	.2357	1296.8	1.641	.97009	7.07559	.20873	1298.4	1.643	.97137	7.08493	.20413
47	90	2.030	.250	.4715	1250.5	1.572	.93544	6.82289	.31024	1250.5	1.573	.93553	6.82349	.31004
48	90	3.000	.375	.7072	1180.2	1.469	.88288	6.43949	.42563	1181.8	1.471	.88415	6.44876	.42312
49	90	4.030	.500	.9430	1001.3	1.205	.74907	5.46354	.65594	1001.3	1.206	.74914	5.46402	.65584

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE I.- DATA[a] FOR 140° CONE; M_∞ = 2.30 - Continued

(b) α = 5°

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 2292.5 psf					Φ = 22.5°, p_t = 2290.5 psf					Φ = 45.0°, p_t = 2291.6 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.100	.100	.1000	1324.1	1.680	.99019	7.22221	.11875	1319.2	1.675	.98740	7.20186	.13470	1320.8	1.675	.98812	7.20712	.13076
2	0	.200	.025	.0471	1303.3	1.650	.97466	7.10896	.19182	1299.5	1.644	.97186	7.08851	.20234	1304.8	1.653	.97617	7.11997	.18592
3	0	.400	.050	.0943	1293.8	1.636	.96750	7.05868	.21778	1292.1	1.635	.96708	7.05364	.21920	1296.9	1.641	.97020	7.07639	.20834
4	0	.600	.075	.1414	1284.2	1.621	.96033	7.00441	.24116	1284.1	1.623	.96110	7.01004	.23875	1288.9	1.629	.96423	7.03282	.22872
5	0	.800	.100	.1886	1274.6	1.607	.95316	6.95214	.26267	1271.3	1.604	.95154	6.94029	.26734	1280.9	1.617	.95825	6.98925	.24758
6	0	1.000	.125	.2357	1265.0	1.593	.94630	6.89987	.28274	1253.3	1.592	.94556	6.89669	.28391	1271.3	1.603	.95108	6.93696	.26864
7	0	1.200	.150	.2829	1253.8	1.577	.93764	6.83888	.30470	1253.7	1.578	.93839	6.84438	.30277	1263.1	1.587	.94272	6.87595	.29152
8	0	1.400	.175	.3300	1242.6	1.560	.92928	6.77790	.32541	1244.2	1.564	.93122	6.79207	.32070	1241.0	1.559	.92838	6.77138	.32756
9	0	1.600	.200	.3772	1233.1	1.546	.92211	6.72563	.34234	1231.4	1.545	.92165	6.72232	.34339	1229.8	1.542	.92002	6.71037	.34716
10	0	1.800	.225	.4243	1220.3	1.527	.91255	6.65593	.36394	1221.8	1.531	.91448	6.67000	.35966	1218.6	1.526	.91165	6.64937	.36592
11	0	2.000	.250	.4715	1213.7	1.513	.90539	6.60366	.37951	1209.0	1.512	.90492	6.60025	.38051	1207.4	1.509	.90329	6.58837	.38397
12	0	2.200	.275	.5186	1199.5	1.497	.89703	6.54268	.39709	1197.8	1.496	.89655	6.53922	.39807	1196.6	1.490	.89373	6.51865	.40386
13	0	2.400	.300	.5658	1185.1	1.476	.88628	6.46427	.41890	1185.1	1.477	.88699	6.46947	.41748	1190.3	1.469	.88298	6.44022	.42543
14	0	2.600	.325	.6129	1170.8	1.454	.87553	6.38586	.43995	1170.7	1.456	.87623	6.39100	.43859	1164.3	1.446	.87103	6.35307	.44855
15	0	2.800	.350	.6601	1154.8	1.431	.86358	6.29874	.46258	1154.7	1.432	.86428	6.30381	.46128	1145.1	1.417	.85669	6.24849	.47531
16	0	3.000	.375	.7072	1137.2	1.405	.85044	6.20291	.48669	1135.5	1.404	.84993	6.19918	.48761	1124.4	1.387	.84116	6.13520	.50330
17	0	3.200	.400	.7544	1115.5	1.374	.83431	6.08966	.51431	1114.8	1.373	.83439	6.08583	.51522	1100.6	1.351	.82324	6.00448	.53455
18	0	3.400	.425	.8015	1092.5	1.339	.81720	5.95898	.54520	1090.8	1.338	.81646	5.95505	.54611	1070.1	1.307	.80053	5.83890	.57284
19	0	3.600	.450	.8487	1063.8	1.297	.79550	5.80216	.58117	1060.5	1.293	.79375	5.78939	.58405	1028.5	1.246	.76947	5.61231	.62349
20	0	3.800	.475	.8958	1022.2	1.236	.75444	5.57565	.63153	1020.6	1.235	.76386	5.57141	.63246	966.3	1.154	.72287	5.27244	.69698
21	0	4.000	.500	.9430	961.5	1.149	.71905	5.24460	.70291	958.3	1.143	.71724	5.23137	.70573	1328.8	1.688	.99410	7.25069	.09201
22	180	.200	.025	.0471	1336.8	1.699	.99966	7.29129	.02196	1333.6	1.696	.99816	7.28033	.05130	1328.8	1.688	.99410	7.25069	.09201
23	180	.400	.050	.0943	1336.8	1.699	.99966	7.29129	.02196	1333.6	1.696	.99816	7.28033	.05130	1328.8	1.688	.99410	7.25069	.09201
24	180	.600	.075	.1414	1335.2	1.697	.99847	7.28257	.04682	1332.0	1.694	.99696	7.27161	.06591	1325.6	1.683	.99171	7.23326	.10914
25	180	.800	.100	.1886	1332.0	1.692	.99608	7.26512	.07497	1327.2	1.687	.99338	7.24545	.09747	1319.2	1.674	.98693	7.19840	.13724
26	180	1.000	.125	.2357	1328.8	1.687	.99368	7.24768	.09518	1322.4	1.680	.98979	7.21930	.12116	1314.4	1.667	.98334	7.17226	.15509
27	180	1.200	.150	.2829	1322.4	1.678	.98890	7.21279	.12637	1317.6	1.672	.98621	7.19314	.14100	1308.0	1.657	.97856	7.13740	.17622
28	180	1.400	.175	.3300	1316.0	1.668	.98412	7.17791	.15141	1311.2	1.663	.98142	7.15826	.16388	1301.6	1.648	.97378	7.10254	.19518
30	180	1.800	.225	.4243	1301.6	1.647	.97336	7.09941	.19680	1296.9	1.642	.97067	7.07979	.20667	1284.1	1.622	.96064	7.00668	.24019
31	180	2.000	.250	.4715	1295.2	1.638	.96857	7.06452	.21407	1288.9	1.630	.96469	7.03620	.22723	1276.1	1.610	.95467	6.96310	.25829
32	180	2.200	.275	.5186	1285.6	1.624	.96140	7.01219	.23781	1279.3	1.616	.95752	6.98388	.24981	1268.1	1.599	.94869	6.91953	.27534
33	180	2.400	.300	.5658	1274.4	1.607	.95303	6.95114	.26307	1269.7	1.602	.95034	6.93157	.27072	1255.3	1.580	.93913	6.84981	.30086
34	180	2.600	.325	.6129	1263.2	1.591	.94466	6.89009	.28635	1256.9	1.583	.94078	6.86182	.29860	1244.2	1.563	.93077	6.78881	.32179
35	180	2.800	.350	.6601	1248.8	1.569	.93390	6.81160	.31411	1242.6	1.562	.93002	6.78335	.32360	1229.8	1.542	.92002	6.71037	.34716
36	180	3.000	.375	.7072	1232.8	1.546	.92194	6.72438	.34274	1225.6	1.538	.91807	6.69616	.35160	1213.8	1.519	.90807	6.62323	.37374
37	180	3.200	.400	.7544	1213.6	1.518	.90759	6.61972	.37478	1207.4	1.510	.90372	6.59153	.38305	1194.6	1.490	.89373	6.51865	.40386
38	180	3.400	.425	.8015	1191.3	1.485	.89085	6.49762	.40972	1183.5	1.475	.88579	6.46075	.41986	1170.7	1.455	.87581	6.38793	.43940
39	180	3.600	.450	.8487	1160.9	1.440	.86813	6.33191	.45405	1153.1	1.430	.86308	6.29509	.46351	1142.3	1.410	.85311	6.22235	.48186
40	180	3.800	.475	.8958	1119.3	1.379	.83704	6.10514	.51058	1113.2	1.371	.83319	6.07711	.51731	1102.0	1.354	.82443	6.01319	.53250
41	180	4.000	.500	.9430	1053.7	1.282	.78801	5.74756	.59346	1047.7	1.275	.78418	5.71964	.59971	1034.9	1.255	.77425	5.64717	.61580
42	270	1.000	.125	.2357	1295.2	1.638	.96857	7.06452	.21407	1306.4	1.656	.97784	7.13211	.17922	1317.6	1.672	.98573	7.18969	.14343
43	270	2.000	.250	.4715	1250.4	1.572	.93509	6.82032	.31112	1266.5	1.597	.94795	6.91413	.27739	1279.3	1.615	.95706	6.98053	.25119
44	270	3.000	.375	.7072	1183.3	1.473	.88487	6.45401	.42169	1199.4	1.498	.89775	6.54794	.39560	1218.6	1.526	.91165	6.64937	.36592
45	270	4.000	.500	.9430	1009.0	1.216	.75453	5.50335	.64731	1023.8	1.239	.76625	5.58885	.62864	1044.5	1.269	.78142	5.69946	.60420
46	90	1.000	.125	.2357	1290.6	1.631	.96511	7.03926	.22582	1276.1	1.611	.95513	6.96645	.25695	1259.7	1.601	.94989	6.92824	.27201
47	90	2.000	.250	.4715	1244.2	1.563	.93047	6.78661	.32252	1228.2	1.541	.91926	6.70488	.34888	1218.6	1.526	.91165	6.64937	.36592
48	90	3.000	.375	.7072	1174.0	1.459	.87791	6.40329	.43533	1156.3	1.435	.86547	6.31252	.45904	1145.1	1.417	.85669	6.24849	.47531
49	90	4.000	.500	.9430	995.7	1.198	.74533	5.43626	.66186	980.6	1.176	.73398	5.35344	.67965	969.4	1.158	.72526	5.28987	.69326

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE I.- DATA[a] FOR 140° CONE; M_∞ = 2.30 - Continued

(b) α = 5° - Concluded

Orifice	e, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 2290.7 psf					Φ = 90.0°, p_t = 2291.3 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.030	.000	.0000	1317.5	1.672	.98635	7.19201	.14180	1320.7	1.676	.99818	7.20756	.13043
2	0	.230	.025	.0471	1307.9	1.658	.97888	7.13971	.17489	1314.3	1.667	.98340	7.17270	.15481
3	0	.430	.050	.0943	1301.6	1.649	.97410	7.10484	.19398	1311.1	1.662	.98101	7.15527	.16571
4	0	.600	.075	.1414	1295.2	1.639	.96932	7.06996	.21146	1304.8	1.653	.97623	7.12041	.18569
5	0	.830	.100	.1886	1288.8	1.630	.96454	7.03509	.22770	1296.8	1.641	.97026	7.07683	.20813
6	0	1.030	.125	.2357	1280.8	1.618	.95856	6.99151	.24663	1290.4	1.632	.96548	7.04197	.22458
7	0	1.230	.150	.2829	1269.6	1.602	.95320	6.93048	.27114	1282.4	1.620	.95951	6.99839	.24373
8	0	1.400	.175	.3300	1261.6	1.590	.94422	6.88690	.28753	1272.8	1.606	.95234	6.94610	.26506
9	0	1.600	.200	.3772	1250.5	1.573	.93585	6.82587	.30921	1264.8	1.594	.94636	6.90252	.28175
10	0	1.830	.225	.4243	1240.9	1.559	.92968	6.77357	.32684	1255.2	1.580	.93919	6.85023	.30072
11	0	2.030	.250	.4715	1228.1	1.540	.91912	6.70383	.34921	1244.1	1.563	.93083	6.78922	.32165
12	0	2.230	.275	.5186	1215.9	1.524	.91075	6.64280	.36790	1232.9	1.547	.92246	6.72827	.34152
13	0	2.400	.300	.5658	1205.7	1.507	.90239	6.58178	.38588	1221.7	1.530	.91410	6.66721	.36051
14	0	2.630	.325	.6129	1193.0	1.489	.89282	6.51204	.40571	1208.9	1.512	.90454	6.59749	.38131
15	0	2.830	.350	.6601	1177.0	1.465	.88087	6.42486	.42957	1193.0	1.488	.89259	6.51033	.40619
16	0	3.030	.375	.7072	1159.4	1.439	.86773	6.32897	.45681	1175.4	1.462	.87945	6.41447	.43235
17	0	3.230	.400	.7544	1147.1	1.406	.85099	6.20692	.48569	1154.6	1.432	.86391	6.30117	.46196
18	0	3.400	.425	.8015	1113.1	1.371	.83306	6.07616	.51754	1130.7	1.396	.84599	6.17044	.49470
19	0	3.630	.450	.8487	1082.8	1.326	.81036	5.91053	.55643	1101.9	1.354	.82448	6.01356	.53241
20	0	3.830	.475	.8958	1039.6	1.263	.77808	5.67515	.60961	1057.2	1.288	.79102	5.76953	.58853
21	0	4.030	.500	.9430	975.8	1.168	.73028	5.32645	.68544	991.7	1.192	.74203	5.41221	.66703
22	180	.200	.025	.0471	1325.4	1.684	.99193	7.23491	.10763	1319.0	1.674	.98689	7.19812	.13744
23	180	.430	.050	.0943	1319.0	1.674	.98715	7.20000	.13607	1312.6	1.664	.98210	7.16322	.16082
24	180	.630	.075	.1414	1317.4	1.672	.98595	7.19127	.14232	1306.2	1.655	.97732	7.12832	.18134
25	180	.800	.100	.1886	1311.0	1.663	.98116	7.15637	.16504	1299.8	1.646	.97253	7.09342	.19986
26	180	1.030	.125	.2357	1303.0	1.651	.97518	7.11273	.18982	1293.4	1.636	.96775	7.05852	.21692
27	180	1.230	.150	.2829	1296.6	1.641	.97040	7.07782	.20764	1283.8	1.622	.96057	7.00617	.24041
28	180	1.430	.175	.3300	1290.2	1.632	.96561	7.04291	.22415	1274.2	1.608	.95339	6.95382	.26201
30	180	1.830	.225	.4243	1271.0	1.604	.95125	6.93818	.26816	1255.0	1.580	.93904	6.84912	.30111
31	180	2.030	.250	.4715	1263.0	1.592	.94527	6.89455	.28471	1247.0	1.568	.93306	6.80549	.31618
32	180	2.230	.275	.5186	1250.2	1.573	.93570	6.82473	.30961	1235.9	1.551	.92468	6.74462	.33634
33	180	2.430	.300	.5658	1239.1	1.556	.92732	6.76364	.33010	1223.1	1.532	.91511	6.67462	.35825
34	180	2.600	.325	.6129	1227.9	1.540	.91894	6.70255	.34961	1210.3	1.514	.90555	6.60482	.37917
35	180	2.830	.350	.6601	1213.5	1.519	.90818	6.62400	.37351	1195.9	1.492	.89478	6.52629	.40172
36	180	3.030	.375	.7072	1197.5	1.495	.89621	6.53673	.39877	1178.3	1.466	.88162	6.43032	.42810
37	180	3.230	.400	.7544	1175.7	1.465	.88065	6.42327	.42999	1159.1	1.438	.86727	6.32562	.45567
38	180	3.430	.425	.8015	1151.1	1.427	.86151	6.28364	.46643	1135.1	1.403	.84932	6.19474	.48871
39	180	3.600	.450	.8487	1119.1	1.380	.83758	6.10909	.50963	1104.8	1.358	.82659	6.02897	.52477
40	180	3.830	.475	.8958	1082.4	1.326	.81006	5.90837	.55693	1066.4	1.302	.79788	5.81957	.57723
41	180	4.030	.500	.9430	1015.2	1.227	.75980	5.54182	.63893	999.2	1.203	.74764	5.45312	.65820
42	270	1.030	.125	.2357	1323.8	1.681	.99374	7.22618	.11538	1327.0	1.686	.99287	7.24174	.10116
43	270	2.030	.250	.4715	1291.8	1.634	.96681	7.05164	.22013	1295.0	1.638	.96895	7.06724	.21277
44	270	3.030	.375	.7072	1229.5	1.542	.92014	6.71127	.34688	1232.7	1.547	.92229	6.72697	.34192
45	270	4.000	.500	.9430	1053.6	1.283	.78852	5.75127	.59263	1056.8	1.287	.79071	5.76722	.58905
46	90	1.030	.125	.2357	1264.8	1.594	.94661	6.90433	.28107	1263.2	1.592	.94517	6.89381	.28498
47	90	2.030	.250	.4715	1213.5	1.514	.90597	6.60793	.37825	1208.9	1.512	.90454	6.59749	.38131
48	90	3.030	.375	.7072	1137.1	1.406	.85099	6.20692	.48569	1133.9	1.401	.84838	6.18787	.49041
49	90	4.030	.500	.9430	963.0	1.150	.72071	5.25671	.70033	959.8	1.144	.71814	5.23790	.70434

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE I.- DATA[a] FOR 140° CONE; $M_\infty = 2.30$ - Continued

(c) $\alpha = 10°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 2293.8 psf					Φ = 22.5°, p_t = 2290.8 psf					Φ = 45.0°, p_t = 2291.6 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.100	.000	.0000	1282.5	1.618	.95853	6.99125	.24674	1280.7	1.618	.95845	6.99073	.24696	1279.3	1.615	.95706	6.98053	.25119
2	0	.200	.025	.0471	1247.3	1.566	.93227	6.79971	.31813	1248.7	1.571	.93452	6.81618	.31254	1250.5	1.573	.93555	6.82367	.30997
3	0	.400	.050	.0943	1244.2	1.562	.92988	6.78230	.32395	1243.9	1.564	.93093	6.79000	.32139	1245.7	1.566	.93197	6.79752	.31887
4	0	.600	.075	.1414	1236.2	1.550	.92391	6.73876	.33815	1235.9	1.552	.92495	6.74636	.33571	1239.4	1.556	.92719	6.76266	.33042
5	0	.800	.100	.1886	1225.0	1.533	.91555	6.67782	.35727	1224.7	1.535	.91657	6.68527	.35497	1233.0	1.547	.92241	6.72780	.34165
6	0	1.000	.125	.2357	1215.4	1.519	.90839	6.62558	.37304	1216.8	1.524	.91059	6.64163	.36825	1226.6	1.537	.91763	6.69294	.35260
7	0	1.200	.150	.2829	1204.2	1.503	.90004	6.56464	.39083	1205.6	1.507	.90222	6.58054	.38624	1213.8	1.519	.90807	6.62323	.37374
8	0	1.400	.175	.3300	1194.6	1.489	.89237	6.51240	.40561	1194.4	1.491	.89386	6.51944	.40366	1204.2	1.504	.90090	6.57094	.38901
9	0	1.600	.200	.3772	1181.9	1.470	.88332	6.44275	.42475	1183.2	1.474	.88546	6.45835	.42051	1196.6	1.490	.89373	6.51865	.40386
10	0	1.800	.225	.4243	1170.7	1.453	.87497	6.38180	.44102	1173.6	1.460	.87828	6.40599	.43461	1183.5	1.474	.88537	6.45765	.42071
11	0	2.000	.250	.4715	1159.5	1.437	.86661	6.32086	.45690	1150.8	1.441	.86871	6.33617	.45295	1172.3	1.457	.87730	6.39664	.43709
12	0	2.200	.275	.5186	1148.3	1.420	.85826	6.25991	.47244	1148.0	1.422	.85914	6.26635	.47081	1159.5	1.439	.86744	6.32692	.45534
13	0	2.400	.300	.5658	1135.5	1.402	.84871	6.19026	.48982	1136.8	1.406	.85076	6.20525	.48611	1146.7	1.420	.85789	6.25721	.47312
14	0	2.600	.325	.6129	1119.6	1.378	.83677	6.10320	.51105	1120.8	1.382	.83880	6.11798	.50748	1134.0	1.401	.84833	6.18749	.49050
15	0	2.800	.350	.6601	1103.6	1.355	.82483	6.01613	.53180	1106.4	1.361	.82803	6.03943	.52629	1118.0	1.377	.83638	6.10034	.51174
16	0	3.000	.375	.7072	1087.6	1.331	.81290	5.92907	.55214	1088.8	1.335	.81487	5.94343	.54881	1102.0	1.354	.82443	6.01319	.53250
17	0	3.200	.400	.7544	1066.9	1.301	.79738	5.81588	.57806	1069.1	1.304	.79931	5.82997	.57487	1079.6	1.321	.80770	5.89119	.56088
18	0	3.400	.425	.8015	1042.9	1.265	.77947	5.68529	.60735	1044.1	1.269	.78136	5.69906	.60429	1055.7	1.286	.78978	5.76046	.59057
19	0	3.600	.450	.8487	1015.8	1.225	.75918	5.53728	.63992	1015.9	1.229	.76102	5.55069	.63699	1028.5	1.246	.76947	5.61231	.62349
20	0	3.800	.475	.8958	977.4	1.169	.73053	5.32832	.68504	976.9	1.170	.73111	5.33250	.68414	990.2	1.189	.74079	5.40316	.66898
21	0	4.000	.500	.9430	921.5	1.087	.68875	5.02360	.74972	919.4	1.085	.68803	5.01831	.75084	931.1	1.102	.69658	5.08071	.73766
22	180	.200	.025	.0471	1314.0	1.657	.98359	7.17408	.15391	1312.8	1.665	.98249	7.16604	.15905	1303.1	1.650	.97487	7.11043	.19104
23	180	.400	.050	.0943	1332.0	1.691	.99553	7.26115	.08002	1324.0	1.682	.99086	7.22707	.11462	1309.5	1.660	.97965	7.14533	.17163
24	180	.600	.075	.1414	1336.8	1.698	.99911	7.28727	.03564	1330.4	1.691	.99564	7.26194	.07904	1311.1	1.662	.98085	7.15405	.16644
25	180	.800	.100	.1886	1338.4	1.700	1.00031	7.29597	.00000	1330.4	1.691	.99564	7.26194	.07904	1312.7	1.664	.98204	7.16278	.16110
26	180	1.000	.125	.2357	1338.4	1.700	1.00031	7.29597	.00000	1330.4	1.691	.99564	7.26194	.07904	1312.7	1.664	.98204	7.16278	.16110
27	180	1.200	.150	.2829	1336.8	1.698	.99911	7.28727	.03564	1328.8	1.689	.99444	7.25322	.09925	1309.5	1.660	.97965	7.14533	.17163
28	180	1.400	.175	.3300	1335.2	1.696	.99792	7.27856	.05458	1325.6	1.684	.99205	7.23579	.10682	1306.7	1.652	.97606	7.11915	.18237
30	180	1.800	.225	.4243	1325.6	1.681	.99076	7.22632	.11526	1317.6	1.672	.98608	7.19220	.14167	1293.5	1.636	.96769	7.05808	.21712
31	180	2.000	.250	.4715	1320.8	1.674	.98717	7.20020	.13592	1311.2	1.663	.98130	7.15733	.16446	1287.1	1.627	.96290	7.02319	.23301
32	180	2.200	.275	.5186	1314.4	1.665	.98240	7.16538	.15947	1303.2	1.651	.97532	7.11374	.18928	1277.5	1.612	.95573	6.97084	.25516
33	180	2.400	.300	.5658	1306.4	1.653	.97643	7.12185	.18490	1295.3	1.639	.96934	7.07015	.21137	1269.5	1.601	.94975	6.92722	.27240
34	180	2.600	.325	.6129	1295.3	1.637	.96808	7.06090	.21579	1285.7	1.625	.96217	7.01784	.23536	1258.3	1.584	.94137	6.86615	.29505
35	180	2.800	.350	.6601	1284.1	1.620	.95972	6.99996	.24306	1272.9	1.606	.95261	6.94810	.26427	1247.1	1.568	.93300	6.80507	.31632
36	180	3.000	.375	.7072	1269.7	1.599	.94898	6.92160	.27455	1258.5	1.585	.94185	6.86964	.29380	1232.7	1.546	.92224	6.72655	.34205
37	180	3.200	.400	.7544	1252.1	1.573	.93585	6.82583	.30923	1241.0	1.559	.92871	6.77374	.32678	1213.6	1.518	.90788	6.62186	.37414
38	180	3.400	.425	.8015	1229.8	1.540	.91913	6.70394	.34918	1218.6	1.526	.91197	6.65169	.36522	1191.2	1.485	.89114	6.49972	.40914
39	180	3.600	.450	.8487	1202.6	1.500	.89884	6.55593	.39332	1191.4	1.486	.89165	6.50349	.40809	1162.4	1.443	.86960	6.34268	.45126
40	180	3.800	.475	.8958	1164.3	1.444	.87019	6.34697	.45014	1151.5	1.427	.86177	6.28554	.46594	1124.0	1.386	.84090	6.13329	.50377
41	180	4.000	.500	.9430	1095.6	1.343	.81887	5.97260	.54202	1082.8	1.326	.81038	5.91068	.55639	1056.9	1.287	.79066	5.76686	.58913
42	270	1.100	.125	.2357	1264.9	1.592	.94540	6.89548	.28437	1290.5	1.632	.96576	7.04399	.22366	1315.9	1.659	.98444	7.18023	.14987
43	270	2.000	.250	.4715	1228.2	1.538	.91794	6.69523	.35189	1261.1	1.587	.94305	6.87836	.29064	1291.9	1.634	.96649	7.04936	.22119
44	270	3.000	.375	.7072	1164.3	1.444	.87019	6.34697	.45014	1202.6	1.503	.90002	6.56451	.39086	1237.5	1.554	.92582	6.75273	.33365
45	270	4.000	.500	.9430	993.4	1.192	.74247	5.41539	.66634	1031.7	1.251	.77213	5.63171	.61921	1066.5	1.301	.79784	5.81921	.57731
46	90	1.000	.125	.2357	1258.5	1.583	.94062	6.86065	.29702	1237.5	1.554	.92615	6.75509	.33289	1223.4	1.533	.91524	6.67551	.35797
47	90	2.000	.250	.4715	1223.2	1.526	.91197	6.65170	.36522	1191.2	1.486	.89145	6.50199	.40851	1172.3	1.457	.87700	6.39664	.43709
48	90	3.000	.375	.7072	1154.7	1.430	.86303	6.29474	.46360	1122.4	1.384	.83999	6.12671	.50537	1100.4	1.351	.82324	6.00448	.53455
49	90	4.000	.500	.9430	983.8	1.178	.73531	5.36315	.67757	952.9	1.135	.71316	5.20159	.71206	935.9	1.109	.70017	5.10686	.73213

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE I.- DATA[a] FOR 140° CONE; $M_\infty = 2.30$ - Continued

(c) $\alpha = 10°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 2289.6 psf					Φ = 90.0°, p_t = 2283.0 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1277.7	1.614	.95570	6.97791	.25227	1274.6	1.615	.95713	6.98110	.25096
2	0	.200	.025	.0471	1261.7	1.591	.94474	6.89068	.28614	1269.8	1.608	.95354	6.95489	.26158
3	0	.400	.050	.0943	1256.9	1.584	.94115	6.86452	.29564	1266.6	1.603	.95114	6.93741	.26845
4	0	.600	.075	.1414	1250.5	1.574	.93637	6.82963	.30792	1266.6	1.603	.95114	6.93741	.26846
5	0	.800	.100	.1886	1244.2	1.565	.93158	6.79474	.31980	1261.8	1.596	.94755	6.91120	.27849
6	0	1.000	.125	.2357	1237.8	1.555	.92680	6.75985	.33134	1257.0	1.589	.94396	6.88499	.28823
7	0	1.200	.150	.2829	1229.8	1.544	.92082	6.71624	.34531	1250.7	1.580	.93917	6.85004	.30078
8	0	1.400	.175	.3300	1220.2	1.530	.91365	6.66390	.36152	1245.9	1.573	.93557	6.82383	.30992
9	0	1.600	.200	.3772	1212.2	1.518	.90767	6.62029	.37461	1237.9	1.561	.92958	6.78014	.32467
10	0	1.800	.225	.4243	1202.6	1.504	.90049	6.56795	.38987	1228.3	1.547	.92239	6.72772	.34168
11	0	2.000	.250	.4715	1193.0	1.490	.89332	6.51562	.40471	1218.8	1.533	.91521	6.67529	.35804
12	0	2.200	.275	.5186	1180.3	1.471	.88375	6.44584	.42391	1209.2	1.518	.90802	6.62287	.37384
13	0	2.400	.300	.5658	1169.1	1.454	.87538	6.38478	.44023	1199.6	1.504	.90083	6.57045	.38916
14	0	2.600	.325	.6129	1156.3	1.435	.86581	6.31501	.45841	1186.9	1.485	.89125	6.50055	.40891
15	0	2.800	.350	.6601	1140.3	1.412	.85385	6.22778	.48050	1170.9	1.462	.87927	6.41317	.43269
16	0	3.000	.375	.7072	1124.4	1.388	.84189	6.14056	.50200	1154.9	1.438	.86729	6.32580	.45563
17	0	3.200	.400	.7544	1103.6	1.358	.82635	6.02717	.52920	1134.2	1.409	.85172	6.21222	.48438
18	0	3.400	.425	.8015	1079.6	1.322	.80841	5.89633	.55970	1111.9	1.375	.83495	6.08989	.51425
19	0	3.600	.450	.8487	1050.9	1.280	.78688	5.73933	.59531	1081.6	1.330	.81219	5.92389	.55334
20	0	3.800	.475	.8958	1011.0	1.221	.75699	5.52127	.64341	1041.7	1.271	.78224	5.70545	.60287
21	0	4.000	.500	.9430	948.7	1.129	.71035	5.18110	.71641	977.9	1.176	.73432	5.35596	.67912
22	180	.200	.025	.0471	1291.9	1.635	.96734	7.05552	.21832	1276.0	1.617	.95820	6.98885	.24774
23	180	.400	.050	.0943	1291.9	1.635	.96734	7.05552	.21832	1269.6	1.608	.95340	6.95386	.26199
24	180	.600	.075	.1414	1291.9	1.635	.96734	7.05552	.21832	1269.6	1.608	.95340	6.95386	.26199
25	180	.800	.100	.1886	1290.3	1.633	.96614	7.04678	.22238	1264.8	1.601	.94980	6.92762	.27225
26	180	1.000	.125	.2357	1287.1	1.628	.96375	7.02932	.23029	1258.4	1.591	.94501	6.89263	.28542
27	180	1.200	.150	.2829	1283.9	1.624	.96135	7.01186	.23796	1253.6	1.584	.94141	6.86639	.29497
28	180	1.400	.175	.3300	1275.9	1.612	.95537	6.96820	.25624	1247.3	1.575	.93661	6.83140	.30730
29	180	1.600	.200	.3772	1263.1	1.593	.94579	6.89834	.28330	1229.7	1.549	.92342	6.73518	.33930
30	180	1.800	.225	.4243	1255.1	1.581	.93980	6.85468	.29914	1221.7	1.537	.91742	6.69145	.35306
31	180	2.000	.250	.4715	1247.1	1.569	.93382	6.81102	.31430	1212.1	1.523	.91023	6.63897	.36905
32	180	2.200	.275	.5186	1235.9	1.553	.92544	6.74989	.33457	1200.9	1.506	.90183	6.57774	.38705
33	180	2.400	.300	.5658	1224.7	1.536	.91706	6.68877	.35389	1189.8	1.490	.89344	6.51651	.40446
34	180	2.600	.325	.6129	1210.4	1.515	.90628	6.61018	.37759	1173.8	1.466	.88145	6.42904	.42844
35	180	2.800	.350	.6601	1196.0	1.494	.89551	6.53159	.40022	1157.8	1.442	.86945	6.34157	.45154
36	180	3.000	.375	.7072	1178.4	1.468	.88234	6.43554	.42669	1138.7	1.414	.85506	6.23660	.47830
37	180	3.200	.400	.7544	1154.4	1.433	.85438	6.30456	.46109	1114.7	1.379	.83707	6.10540	.51057
38	180	3.400	.425	.8015	1125.6	1.390	.84283	6.14738	.50034	1086.0	1.336	.81549	5.94795	.54776
39	180	3.600	.450	.8487	1087.2	1.333	.81410	5.93781	.55012	1047.6	1.280	.78670	5.73803	.59560
40	180	3.800	.475	.8958	1087.2	1.333	.81410	5.93781	.55012	985.4	1.187	.73993	5.39689	.67032
41	180	4.000	.500	.9430	1021.7	1.237	.76501	5.57980	.63063	1336.7	1.707	1.00377	7.32121	.00000
42	270	1.000	.125	.2357	1333.5	1.597	.99846	7.28255	.04685	1319.1	1.681	.99058	7.22502	.11638
43	270	2.000	.250	.4715	1315.9	1.571	.98530	7.18650	.14563	1271.2	1.610	.95460	6.96261	.25849
44	270	3.000	.375	.7072	1263.1	1.593	.94579	6.89834	.28330	1101.9	1.360	.82748	6.03542	.52724
45	270	4.000	.500	.9430	1093.6	1.343	.81888	5.97274	.54199	1210.8	1.521	.90922	6.63161	.37125
46	90	1.000	.125	.2357	1215.4	1.522	.91006	6.63773	.36942	1155.5	1.441	.86849	6.33454	.45337
47	90	2.000	.250	.4715	1161.1	1.442	.86940	6.34117	.45165	1083.2	1.332	.81338	5.93262	.55132
48	90	3.000	.375	.7072	1087.6	1.334	.81439	5.93994	.54962	918.9	1.089	.69000	5.03268	.74780
49	90	4.000	.500	.9430	923.1	1.091	.69121	5.04154	.74594					

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE I.- DATA[a] FOR 140° CONE; $M_\infty = 2.30$ - Continued

(d) $\alpha = 15°$

Orifice	θ, deg	s, in.	s/D	s/s*	$\Phi = 0.0°$, $p_t = 2290.5$ psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.030	.000	.0000	1215.4	1.522	.90970	6.63513	.37020
2	0	.230	.025	.0471	1164.3	1.446	.87145	6.35612	.44776
3	0	.430	.050	.0943	1172.3	1.458	.87742	6.39971	.43628
4	0	.630	.075	.1414	1170.7	1.456	.87623	6.39100	.43859
5	0	.830	.100	.1886	1164.3	1.446	.87145	6.35612	.44776
6	0	1.030	.125	.2357	1153.1	1.430	.86308	6.29509	.46351
7	0	1.230	.150	.2829	1143.5	1.416	.85591	6.24277	.47675
8	0	1.430	.175	.3300	1132.4	1.399	.84754	6.18174	.49192
9	0	1.630	.200	.3772	1121.2	1.383	.83917	6.12071	.50692
10	0	1.830	.225	.4243	1113.0	1.366	.83080	6.05967	.52148
11	0	2.000	.250	.4715	1097.2	1.348	.82124	5.98992	.53797
12	0	2.230	.275	.5186	1086.0	1.331	.81287	5.92889	.55218
13	0	2.430	.300	.5658	1074.9	1.315	.80451	5.86786	.56623
14	0	2.630	.325	.6129	1060.5	1.293	.79375	5.78939	.58405
15	0	2.800	.350	.6601	1046.1	1.272	.78299	5.71092	.60165
16	0	3.030	.375	.7072	1030.1	1.249	.77103	5.62373	.62097
17	0	3.230	.400	.7544	1011.0	1.220	.75669	5.51910	.64388
18	0	3.430	.425	.8015	990.2	1.190	.74115	5.40575	.66842
19	0	3.630	.450	.8487	964.7	1.152	.72202	5.26625	.69830
20	0	3.800	.475	.8958	931.1	1.103	.69692	5.08315	.73715
21	0	4.030	.500	.9430	883.0	1.027	.65867	4.80414	.79594
22	180	.230	.025	.0471	1272.7	1.606	.95260	6.94800	.26431
23	180	.430	.050	.0943	1306.3	1.656	.97773	7.13130	.17967
24	180	.630	.075	.1414	1322.3	1.679	.98970	7.21859	.12173
25	180	.830	.100	.1886	1330.3	1.691	.99568	7.26223	.07868
26	180	1.030	.125	.2357	1335.1	1.698	.99927	7.28842	.03232
27	180	1.230	.150	.2829	1339.9	1.705	1.00286	7.31460	.00000
28	180	1.400	.175	.3300	1341.5	1.708	1.00406	7.32333	.00000
30	180	1.830	.225	.4243	1336.7	1.701	1.00047	7.29715	.00003
31	180	2.000	.250	.4715	1335.1	1.698	.99927	7.28842	.03232
32	180	2.230	.275	.5186	1331.9	1.693	.99688	7.27096	.06687
33	180	2.430	.300	.5658	1325.5	1.684	.99209	7.23605	.10658
34	180	2.630	.325	.6129	1319.1	1.675	.98730	7.20113	.13524
35	180	2.800	.350	.6601	1312.7	1.665	.98251	7.16622	.15894
36	180	3.030	.375	.7072	1301.5	1.649	.97414	7.10512	.19384
37	180	3.230	.400	.7544	1287.1	1.627	.96337	7.02656	.23152
38	180	3.430	.425	.8015	1267.9	1.599	.94901	6.92181	.27447
39	180	3.630	.450	.8487	1242.3	1.561	.92986	6.78216	.32400
40	180	3.800	.475	.8958	1207.2	1.510	.90353	6.59013	.38346
41	180	4.000	.500	.9430	1160.0	1.411	.85327	6.22352	.48157
42	270	1.030	.125	.2357	1215.2	1.521	.90951	6.63377	.37060
43	270	2.030	.250	.4715	1189.6	1.484	.89037	6.49411	.41070
44	270	3.000	.375	.7072	1133.6	1.401	.84848	6.18861	.49023
45	270	4.000	.500	.9430	972.1	1.163	.72761	5.30702	.68960
46	90	1.030	.125	.2357	1207.4	1.510	.90372	6.59153	.38305
47	90	2.030	.250	.4715	1180.3	1.470	.88340	6.44331	.42460
48	90	3.030	.375	.7072	1122.8	1.385	.84037	6.12943	.50471
49	90	4.030	.500	.9430	959.9	1.145	.71844	5.24009	.70387

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE I.- DATA[a] FOR 140° CONE; M_∞ = 2.30 - Continued

(e) α = 20°

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 2289.9 psf					Φ = 22.5°, p_t = 2290.3 psf					Φ = 45.0°, p_t = 2290.3 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1117.6	1.378	.83673	6.10292	.51112	1116.7	1.376	.83593	6.09704	.51253	1115.4	1.376	.83566	6.09508	.51300
2	0	.200	.025	.0471	1058.5	1.291	.79244	5.77988	.58620	1059.3	1.292	.79294	5.78347	.58539	1068.5	1.305	.79979	5.83349	.57407
3	0	.400	.050	.0943	1084.0	1.329	.81160	5.91957	.55434	1078.5	1.320	.80727	5.88799	.56161	1079.6	1.322	.80816	5.89453	.56011
4	0	.600	.075	.1414	1093.6	1.343	.81878	5.97195	.54217	1084.8	1.329	.81204	5.92283	.55359	1084.4	1.329	.81175	5.92069	.55408
5	0	.800	.100	.1886	1087.2	1.333	.81399	5.93703	.55030	1080.0	1.322	.80846	5.89670	.55961	1082.8	1.326	.81055	5.91197	.55609
6	0	1.000	.125	.2357	1077.7	1.319	.80681	5.88465	.56238	1073.7	1.313	.80368	5.86185	.56760	1078.1	1.319	.80697	5.88581	.56211
7	0	1.200	.150	.2829	1068.1	1.305	.79962	5.83226	.57434	1065.7	1.301	.79771	5.81831	.57751	1071.7	1.310	.80218	5.85093	.57009
8	0	1.400	.175	.3300	1060.1	1.293	.79364	5.78861	.58423	1059.3	1.292	.79294	5.78347	.58539	1066.9	1.303	.79860	5.82477	.57605
9	0	1.600	.200	.3772	1052.1	1.281	.78765	5.74495	.59405	1049.7	1.278	.78577	5.73121	.59712	1058.9	1.291	.79262	5.78117	.58591
10	0	1.800	.225	.4243	1040.9	1.265	.77928	5.68384	.60768	1040.2	1.264	.77861	5.67895	.60876	1052.5	1.282	.78784	5.74629	.59375
11	0	2.000	.250	.4715	1032.9	1.253	.77329	5.64018	.61734	1030.6	1.249	.77144	5.62669	.62032	1042.9	1.268	.78067	5.69398	.60543
12	0	2.200	.275	.5186	1021.7	1.237	.76491	5.57907	.63079	1021.0	1.235	.76428	5.57443	.63180	1033.3	1.253	.77349	5.64166	.61702
13	0	2.400	.300	.5658	1010.5	1.220	.75653	5.51795	.64413	1009.9	1.219	.75592	5.51346	.64511	1025.3	1.242	.76751	5.59806	.62662
14	0	2.600	.325	.6129	999.3	1.204	.74815	5.45683	.65739	998.7	1.202	.74756	5.45249	.65833	1014.2	1.225	.75915	5.53702	.63998
15	0	2.800	.350	.6601	984.9	1.182	.73738	5.37825	.67433	985.9	1.184	.73800	5.38281	.67335	1001.4	1.206	.74958	5.46726	.65513
16	0	3.000	.375	.7072	972.1	1.163	.72780	5.30841	.68930	971.6	1.162	.72726	5.30442	.69015	987.0	1.185	.73882	5.38879	.67207
17	0	3.200	.400	.7544	956.1	1.140	.71583	5.22110	.70791	957.2	1.141	.71651	5.22603	.70686	971.0	1.162	.72687	5.30159	.69076
18	0	3.400	.425	.8015	938.5	1.114	.70266	5.12506	.72828	938.1	1.113	.70218	5.12151	.72903	951.9	1.133	.71252	5.19695	.71304
19	0	3.600	.450	.8487	916.2	1.081	.68591	5.00282	.75410	917.3	1.082	.68665	5.00828	.75295	927.9	1.098	.69459	5.06616	.74074
20	0	3.800	.475	.8958	887.4	1.039	.66436	4.84567	.78720	887.0	1.038	.66396	4.84279	.78781	896.0	1.051	.67068	4.89176	.77750
21	0	4.000	.500	.9430	841.0	.970	.62964	4.59247	.84055	840.7	.970	.62933	4.59020	.84103	948.1	.980	.63481	4.63017	.83259
22	180	.200	.025	.0471	1204.0	1.505	.90137	6.57439	.38802	1194.6	1.491	.89424	6.52235	.40282	1172.3	1.458	.87750	6.40027	.43613
23	180	.400	.050	.0943	1261.5	1.590	.94447	6.88870	.28686	1245.7	1.567	.93249	6.80138	.31757	1207.4	1.510	.90380	6.59211	.38288
24	180	.600	.075	.1414	1288.7	1.630	.96482	7.03713	.22678	1271.3	1.604	.95162	6.94090	.26710	1229.8	1.543	.92054	6.71418	.34596
25	180	.800	.100	.1886	1303.1	1.652	.97559	7.11571	.18823	1284.1	1.623	.96119	7.01065	.23849	1241.0	1.560	.92891	6.77522	.32630
26	180	1.000	.125	.2357	1314.3	1.668	.98397	7.17683	.15212	1295.3	1.640	.96956	7.07169	.21063	1250.5	1.574	.93608	6.82754	.30864
27	180	1.200	.150	.2829	1322.3	1.680	.98995	7.22048	.12018	1303.2	1.651	.97553	7.11529	.18845	1253.7	1.578	.93847	6.84498	.30256
28	180	1.400	.175	.3300	1328.7	1.689	.99474	7.25540	.08681	1309.6	1.661	.98031	7.15017	.16877	1250.1	1.588	.94325	6.87986	.29010
30	180	1.800	.225	.4243	1335.1	1.699	.99953	7.29033	.02589	1314.4	1.668	.98390	7.17633	.15244	1260.1	1.588	.94325	6.87986	.29010
31	180	2.000	.250	.4715	1336.7	1.701	1.00073	7.29906	.00000	1315.0	1.670	.98510	7.18505	.14662	1261.7	1.590	.94445	6.88858	.28691
32	180	2.200	.275	.5186	1335.1	1.699	.99953	7.29033	.02589	1316.0	1.670	.98510	7.18505	.14662	1260.1	1.588	.94325	6.87986	.29010
33	180	2.400	.300	.5658	1336.7	1.701	1.00073	7.29906	.00000	1314.4	1.668	.98390	7.17633	.15244	1256.9	1.583	.94086	6.86242	.29639
34	180	2.600	.325	.6129	1335.1	1.699	.99953	7.29033	.02589	1311.2	1.663	.98151	7.15889	.16359	1250.5	1.574	.93608	6.82754	.30864
35	180	2.800	.350	.6601	1330.3	1.692	.99594	7.26413	.07626	1306.4	1.656	.97792	7.13273	.17887	1244.2	1.564	.93130	6.79266	.32050
36	180	3.000	.375	.7072	1323.9	1.682	.99115	7.22921	.11275	1298.5	1.644	.97195	7.08913	.20203	1234.6	1.550	.92413	6.74034	.33765
37	180	3.200	.400	.7544	1314.3	1.668	.98397	7.17683	.15212	1290.5	1.633	.96597	7.04553	.22295	1223.4	1.534	.91576	6.67930	.35681
38	180	3.400	.425	.8015	1301.5	1.649	.97439	7.10698	.19286	1274.5	1.609	.95401	6.95833	.26021	1205.8	1.508	.90261	6.58339	.38542
39	180	3.600	.450	.8487	1280.7	1.619	.95883	6.99348	.24580	1253.7	1.578	.93847	6.84498	.30256	1181.9	1.472	.88467	6.45259	.42208
40	180	3.800	.475	.8958	1250.3	1.574	.93609	6.82759	.30862	1221.8	1.531	.91456	6.67058	.35948	1149.9	1.425	.86076	6.27820	.46781
41	180	4.000	.500	.9430	1188.0	1.482	.88940	6.48708	.41264	1159.5	1.440	.86794	6.33052	.45441	1086.0	1.331	.81294	5.92941	.55206
42	270	1.000	.125	.2357	1143.2	1.416	.85589	6.24262	.47679	1197.8	1.496	.89663	6.53979	.39791	1253.7	1.578	.93847	6.84498	.30255
43	270	2.000	.250	.4715	1130.4	1.397	.84631	6.17277	.49413	1197.8	1.496	.89663	6.53979	.39791	1266.5	1.597	.94804	6.91474	.27716
44	270	3.000	.375	.7072	1087.2	1.333	.81399	5.93703	.55030	1152.7	1.444	.87033	6.34795	.44988	1244.2	1.564	.93130	6.79266	.32050
45	270	4.000	.500	.9430	938.5	1.114	.70266	5.12506	.72828	1014.2	1.225	.75915	5.53702	.63998	1098.8	1.350	.82251	5.99917	.53580
46	90	1.000	.125	.2357	1133.6	1.402	.84870	6.19023	.48983	1094.4	1.344	.81921	5.97509	.54144	1078.1	1.319	.80697	5.88581	.56211
47	90	2.000	.250	.4715	1120.8	1.383	.83913	6.12038	.50690	1070.5	1.308	.80129	5.84444	.57157	1042.9	1.268	.78067	5.69398	.60543
48	90	3.000	.375	.7072	1074.5	1.314	.80441	5.86719	.56638	1017.8	1.231	.76189	5.55701	.63561	985.4	1.183	.73763	5.38007	.67394
49	90	4.000	.500	.9430	924.2	1.093	.69189	5.04648	.74489	875.8	1.021	.65560	4.78182	.80064	849.7	.983	.63601	4.63889	.83075

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.
Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE I.- DATA[a] FOR 140° CONE; M_∞ = 2.30 - Concluded

(e) α = 20° - Concluded

Orifice	e, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 2291.9 psf					Φ = 90.0°, p_t = 2290.1 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1116.4	1.375	.83508	6.09083	.51402	1115.1	1.374	.83475	6.08843	.51460
2	0	.200	.025	.0471	1086.0	1.330	.81238	5.92527	.55302	1111.9	1.369	.83236	6.07101	.51877
3	0	.400	.050	.0943	1089.2	1.335	.81477	5.94270	.54898	1118.3	1.379	.83714	6.10585	.51041
4	0	.600	.075	.1414	1095.6	1.344	.81954	5.97755	.54086	1127.8	1.393	.84430	6.15812	.49772
5	0	.800	.100	.1886	1097.2	1.347	.82074	5.98626	.53882	1132.6	1.400	.84788	6.18425	.49130
6	0	1.000	.125	.2357	1095.6	1.344	.81954	5.97755	.54086	1134.2	1.402	.84908	6.19296	.48915
7	0	1.200	.150	.2829	1092.4	1.339	.81716	5.96012	.54493	1135.8	1.405	.85027	6.20167	.48700
8	0	1.400	.175	.3300	1090.8	1.337	.81596	5.95141	.54696	1134.2	1.402	.84908	6.19296	.48915
9	0	1.600	.200	.3772	1084.4	1.328	.81118	5.91656	.55504	1131.0	1.398	.84669	6.17554	.49345
10	0	1.800	.225	.4243	1079.6	1.321	.80760	5.89041	.56106	1129.4	1.395	.84549	6.16683	.49558
11	0	2.000	.250	.4715	1073.3	1.311	.80282	5.85556	.56904	1121.4	1.384	.83952	6.12327	.50620
12	0	2.200	.275	.5186	1065.3	1.299	.79685	5.81199	.57894	1115.1	1.374	.83475	6.08843	.51460
13	0	2.400	.300	.5658	1054.1	1.283	.78848	5.75100	.59269	1108.7	1.365	.82997	6.05359	.52293
14	0	2.600	.325	.6129	1046.1	1.271	.78251	5.70743	.60243	1100.7	1.353	.82400	6.01004	.53324
15	0	2.800	.350	.6601	1033.3	1.252	.77295	5.63772	.61789	1089.5	1.337	.81564	5.94907	.54750
16	0	3.000	.375	.7072	1023.6	1.234	.76339	5.56801	.63321	1076.8	1.318	.80609	5.87939	.56359
17	0	3.200	.400	.7544	1004.6	1.210	.75145	5.48087	.65219	1062.4	1.297	.79534	5.80100	.58143
18	0	3.400	.425	.8015	983.8	1.179	.73592	5.36760	.67662	1041.7	1.266	.77781	5.68776	.60681
19	0	3.600	.450	.8487	961.5	1.147	.71919	5.24561	.70270	1017.8	1.231	.76190	5.55711	.63559
20	0	3.800	.475	.8958	924.7	1.092	.69171	5.04519	.74516	981.1	1.177	.73443	5.35678	.67894
21	0	4.000	.500	.9430	872.0	1.015	.65229	4.75764	.80573	922.0	1.090	.69025	5.03450	.74742
22	180	.200	.025	.0471	1149.6	1.424	.85992	6.27206	.46937	1119.5	1.381	.83806	6.11263	.50877
23	180	.400	.050	.0943	1152.4	1.443	.86949	6.34185	.45147	1119.5	1.381	.83806	6.11263	.50877
24	180	.600	.075	.1414	1180.0	1.468	.88265	6.43780	.42608	1132.3	1.400	.84763	6.18239	.49176
25	180	.800	.100	.1886	1186.4	1.478	.88743	6.47270	.41659	1133.9	1.402	.84882	6.19111	.48961
26	180	1.000	.125	.2357	1192.8	1.487	.89221	6.50759	.40695	1137.1	1.407	.85122	6.20855	.48529
27	180	1.200	.150	.2829	1194.4	1.490	.89341	6.51631	.40452	1135.5	1.404	.85002	6.19983	.48745
28	180	1.400	.175	.3300	1196.0	1.492	.89461	6.52504	.40207	1135.5	1.404	.85002	6.19983	.48745
30	180	1.800	.225	.4243	1194.4	1.490	.89341	6.51631	.40452	1130.7	1.397	.84643	6.17367	.49390
31	180	2.000	.250	.4715	1191.2	1.485	.89102	6.49887	.40938	1124.3	1.388	.84165	6.13879	.50243
32	180	2.200	.275	.5186	1188.0	1.480	.88863	6.48142	.41420	1117.9	1.378	.83687	6.10391	.51088
33	180	2.400	.300	.5658	1181.6	1.471	.88384	6.44653	.42372	1111.5	1.369	.83209	6.06903	.51925
34	180	2.600	.325	.6129	1175.2	1.461	.87906	6.41163	.43311	1103.5	1.357	.82611	6.02543	.52961
35	180	2.800	.350	.6601	1155.6	1.447	.87188	6.35929	.44693	1092.4	1.341	.81774	5.96439	.54394
36	180	3.000	.375	.7072	1154.4	1.431	.86351	6.29823	.46271	1079.6	1.322	.80818	5.89463	.56009
37	180	3.200	.400	.7544	1141.6	1.412	.85394	6.22844	.48034	1063.6	1.298	.79622	5.80744	.57998
38	180	3.400	.425	.8015	1122.4	1.384	.83959	6.12377	.50608	1046.0	1.272	.78307	5.71152	.60152
39	180	3.600	.450	.8487	1098.4	1.348	.82165	5.99292	.53726	1020.5	1.235	.76394	5.57200	.63233
40	180	3.800	.475	.8958	1063.3	1.297	.79534	5.80100	.58143	986.9	1.185	.73884	5.38888	.67205
41	180	4.000	.500	.9430	1000.9	1.205	.74870	5.46079	.65654	927.9	1.098	.69460	5.06625	.74072
42	270	1.000	.125	.2357	1299.9	1.645	.97235	7.09205	.20055	1314.3	1.668	.98392	7.17646	.15236
43	270	2.000	.250	.4715	1319.1	1.673	.98670	7.19673	.13844	1336.7	1.701	1.00066	7.29853	.00000
44	270	3.000	.375	.7072	1303.1	1.650	.97474	7.10950	.19153	1325.5	1.684	.99229	7.23749	.10523
45	270	4.000	.500	.9430	1167.2	1.450	.87308	6.36802	.44464	1191.4	1.487	.89186	6.50503	.40767
46	90	1.000	.125	.2357	1074.9	1.314	.80401	5.86427	.56705	1078.4	1.320	.80728	5.88810	.56159
47	90	2.000	.250	.4715	1030.1	1.248	.77056	5.62029	.62173	1032.1	1.252	.77265	5.63550	.61838
48	90	3.000	.375	.7072	971.0	1.161	.72636	5.29789	.69155	971.5	1.162	.72727	5.30452	.69013
49	90	4.000	.500	.9430	844.9	.975	.63198	4.60951	.83695	843.9	.974	.63173	4.60770	.83733

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.
Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE II.- DATA[a] FOR 140° CONE; $M_\infty = 2.96$

(a) $\alpha = 0°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 3240.6 psf					Φ = 22.5°, p_t = 3242.4 psf					Φ = 45.0°, p_t = 3240.7 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.200	.000	.0000	1087.9	1.730	.98801	11.61259	.13141	1087.5	1.729	.98704	11.60119	.13666	1087.9	1.730	.98791	11.61143	.13195
2	0	.230	.025	.0471	1083.2	1.722	.98366	11.56151	.15359	1082.7	1.720	.98269	11.55008	.15815	1083.1	1.722	.98356	11.56035	.15406
3	0	.400	.050	.0943	1076.8	1.711	.97787	11.49340	.17911	1077.9	1.712	.97834	11.49897	.17715	1078.3	1.714	.97922	11.50928	.17348
4	0	.600	.075	.1414	1072.0	1.703	.97352	11.44232	.19618	1071.5	1.701	.97254	11.43083	.19983	1071.9	1.702	.97342	11.44117	.19655
5	0	.800	.100	.1886	1065.6	1.692	.96772	11.37421	.21700	1065.1	1.690	.96674	11.36269	.22034	1057.1	1.694	.96908	11.39010	.21231
6	0	1.000	.125	.2357	1057.6	1.678	.96048	11.28908	.24070	1058.7	1.679	.96095	11.29455	.23924	1052.8	1.669	.95604	11.23687	.25424
7	0	1.230	.150	.2829	1051.3	1.667	.95459	11.22097	.25824	1050.8	1.665	.95370	11.20937	.26112	1044.8	1.655	.94880	11.15174	.27505
8	0	1.430	.175	.3300	1043.3	1.653	.94744	11.13583	.27879	1044.4	1.654	.94790	11.14123	.27753	1036.8	1.641	.94155	11.06661	.29458
9	0	1.600	.200	.3772	1036.9	1.642	.94165	11.06772	.29433	1036.4	1.640	.94066	11.05605	.29693	1030.4	1.630	.93576	10.99851	.30945
10	0	1.830	.225	.4243	1028.9	1.628	.93440	10.98259	.31284	1033.0	1.629	.93486	10.98791	.31171	1022.5	1.616	.92852	10.91338	.32724
11	0	2.030	.250	.4715	1019.4	1.611	.92571	10.88042	.33391	1020.4	1.612	.92616	10.88569	.33285	1011.3	1.597	.91838	10.79420	.35090
12	0	2.230	.275	.5186	1009.8	1.594	.91702	10.77826	.35397	1010.8	1.595	.91746	10.78348	.35297	1003.3	1.583	.91113	10.70907	.36706
13	0	2.400	.300	.5658	1001.8	1.580	.90978	10.69312	.37003	1002.8	1.581	.91022	10.69830	.36907	992.2	1.564	.90099	10.58990	.38882
14	0	2.630	.325	.6129	989.0	1.558	.89819	10.55690	.39468	991.7	1.562	.90007	10.57906	.39075	979.4	1.541	.88941	10.45369	.41263
15	0	2.800	.350	.6601	977.9	1.539	.88805	10.43771	.41536	978.9	1.540	.88848	10.44277	.41450	965.0	1.516	.87637	10.30046	.43832
16	0	3.000	.375	.7072	963.5	1.514	.87501	10.28447	.44094	964.5	1.515	.87543	10.28945	.44013	947.5	1.486	.86044	10.11318	.46842
17	0	3.200	.400	.7544	947.6	1.486	.86052	10.11420	.46826	948.6	1.487	.86094	10.11910	.46749	925.8	1.450	.84160	9.89185	.50251
18	0	3.430	.425	.8015	926.8	1.450	.84169	9.89284	.50236	927.8	1.451	.84210	9.89763	.50164	902.8	1.408	.81988	9.63646	.54033
19	0	3.600	.450	.8487	902.9	1.408	.81996	9.63743	.54016	903.8	1.409	.82036	9.64210	.53948	867.7	1.347	.78801	9.26190	.59347
20	0	3.800	.475	.9958	867.8	1.347	.78809	9.26283	.59334	868.7	1.348	.78847	9.26732	.59271	815.1	1.255	.74021	8.70006	.66990
21	0	4.000	.500	.9430	813.6	1.253	.73883	8.68391	.67205	814.4	1.254	.73919	8.68811	.67149	1090.3	1.734	.99010	11.63723	.11929
22	180	.230	.025	.0471	1092.0	1.737	.99165	11.65547	.10949	1092.3	1.737	.99138	11.65229	.11125	1082.3	1.720	.98284	11.55192	.15743
23	180	.400	.050	.0943	1085.6	1.726	.98585	11.58721	.14285	1084.3	1.723	.98414	11.56712	.15131	1077.5	1.712	.97849	11.50073	.17653
24	180	.630	.075	.1414	1079.2	1.715	.98004	11.51894	.16997	1079.5	1.715	.97979	11.51601	.17104	1071.1	1.701	.97268	11.43267	.19932
25	180	.800	.100	.1886	1074.4	1.707	.97568	11.46775	.18786	1073.1	1.704	.97399	11.44787	.19443	1064.7	1.690	.96687	11.36422	.21990
26	180	1.000	.125	.2357	1069.6	1.698	.97133	11.41655	.20429	1066.7	1.692	.96819	11.37972	.21538	1056.7	1.676	.95962	11.27890	.24339
27	180	1.230	.150	.2829	1061.6	1.684	.96407	11.33123	.22926	1058.7	1.679	.96095	11.29455	.23924	1050.3	1.665	.95381	11.21065	.26081
28	180	1.430	.175	.3300	1055.2	1.673	.95826	11.26297	.24755	1052.4	1.667	.95515	11.22640	.25688	1034.3	1.637	.93929	11.04001	.30046
30	180	1.830	.225	.4243	1039.2	1.646	.94374	11.09232	.28883	1038.0	1.642	.94210	11.07309	.29314	1027.9	1.626	.93348	10.97176	.31513
31	180	2.000	.250	.4715	1031.2	1.632	.93648	11.00699	.30763	1030.0	1.629	.93486	10.98791	.31171	1018.4	1.609	.92477	10.86938	.33613
32	180	2.200	.275	.5186	1023.2	1.618	.92922	10.92167	.32554	1020.4	1.612	.92616	10.88569	.33285	1008.8	1.593	.91606	10.76700	.35613
33	180	2.400	.300	.5658	1013.6	1.601	.92051	10.81928	.34603	1010.8	1.595	.91746	10.78348	.35297	999.2	1.576	.90735	10.66462	.37529
34	180	2.630	.325	.6129	1002.4	1.582	.91035	10.69982	.36878	999.7	1.576	.90732	10.66423	.37536	988.4	1.554	.89574	10.52811	.39975
35	180	2.800	.350	.6601	991.2	1.562	.90018	10.58036	.39052	986.9	1.554	.89572	10.52795	.39977	973.6	1.531	.88412	10.39160	.42317
36	180	3.000	.375	.7072	978.5	1.540	.88857	10.44384	.41432	974.1	1.531	.88413	10.39166	.42316	957.6	1.503	.86961	10.22097	.45125
37	180	3.200	.400	.7544	959.3	1.506	.87115	10.23906	.44433	958.1	1.504	.86963	10.22131	.45120	936.8	1.467	.85373	9.99915	.48616
38	180	3.400	.425	.8015	941.7	1.476	.85517	10.05135	.47809	937.4	1.467	.85079	9.99985	.48606	911.2	1.423	.82750	9.72613	.52720
39	180	3.630	.450	.8487	914.5	1.429	.83049	9.76124	.52202	911.8	1.423	.82760	9.72728	.52703	879.3	1.367	.79847	9.38486	.57626
40	180	3.800	.475	.8958	884.1	1.376	.80291	9.43700	.56889	879.9	1.367	.79861	9.38657	.57602	824.9	1.273	.74911	8.80471	.65588
41	180	4.000	.500	.9430	828.2	1.278	.75209	8.83972	.65117	825.6	1.273	.74934	8.80736	.65552	1069.5	1.698	.97123	11.41541	.20464
42	270	1.000	.125	.2357	1068.0	1.696	.96987	11.39949	.20950	1068.3	1.695	.96964	11.39676	.21032	1031.1	1.631	.93639	11.00589	.30787
43	270	2.030	.250	.4715	1031.2	1.632	.93648	11.00699	.30763	1030.0	1.629	.93486	10.98791	.31171	975.8	1.537	.88703	10.42573	.41740
44	270	3.000	.375	.7072	975.3	1.534	.88566	10.40971	.42012	974.1	1.531	.88413	10.39166	.42316	831.3	1.284	.75492	8.87296	.64669
45	270	4.000	.500	.9430	829.8	1.281	.75354	8.85679	.64887	830.4	1.281	.75368	8.85847	.64865	1056.0	1.675	.95894	11.27092	.24548
46	90	1.000	.125	.2357	1057.6	1.678	.96048	11.28908	.24070	1055.5	1.673	.95805	11.26048	.24820	1019.3	1.611	.92562	10.87933	.33413
47	90	2.000	.250	.4715	1020.9	1.614	.92716	10.89745	.33048	1018.8	1.609	.92471	10.86866	.33627	963.5	1.514	.87492	10.28344	.44111
48	90	3.000	.375	.7072	963.5	1.514	.87501	10.28447	.44094	962.9	1.512	.87398	10.27242	.44291	818.3	1.281	.74310	8.73411	.66535
49	90	4.000	.500	.9430	815.8	1.258	.74173	8.71796	.66751	816.0	1.256	.74064	8.70515	.66922					

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE II.- DATA[a] FOR 140° CONE; $M_\infty = 2.96$ - Continued

(a) $\alpha = 0°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 3240.2 psf					Φ = 90.0°, p_t = 3241.2 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.030	.000	.0000	1088.6	1.732	.98873	11.62115	.12732	1087.4	1.729	.98733	11.60467	.13508
2	0	.230	.025	.0471	1083.8	1.723	.98438	11.56996	.15014	1084.2	1.724	.98443	11.57059	.14988
3	0	.400	.050	.0943	1080.6	1.718	.98147	11.53583	.16366	1079.4	1.715	.98008	11.51947	.16977
4	0	.630	.075	.1414	1075.8	1.710	.97712	11.48464	.18214	1073.0	1.704	.97428	11.45131	.19378
5	0	.800	.100	.1886	1069.4	1.698	.97131	11.41638	.20436	1068.2	1.696	.96993	11.40019	.20929
6	0	1.030	.125	.2357	1063.0	1.687	.96550	11.34812	.22450	1061.9	1.685	.96414	11.33202	.22902
7	0	1.230	.150	.2829	1053.4	1.671	.95679	11.24573	.25199	1055.5	1.674	.95834	11.26386	.24732
8	0	1.430	.175	.3300	1047.1	1.659	.95099	11.17747	.26891	1049.1	1.662	.95254	11.19570	.26448
9	0	1.630	.200	.3772	1037.5	1.643	.94227	11.07508	.29269	1039.5	1.646	.94384	11.09346	.28855
10	0	1.800	.225	.4243	1031.1	1.632	.93647	11.00682	.30767	1031.5	1.632	.93659	11.00825	.30736
11	0	2.030	.250	.4715	1021.5	1.615	.92776	10.90443	.32906	1023.5	1.618	.92934	10.92305	.32526
12	0	2.230	.275	.5186	1013.5	1.601	.92050	10.81911	.34606	1012.4	1.598	.91919	10.80376	.34905
13	0	2.400	.300	.5658	1002.3	1.582	.91033	10.69965	.36882	1004.4	1.585	.91194	10.71856	.36529
14	0	2.600	.325	.6129	992.7	1.565	.90162	10.59726	.38750	993.2	1.565	.90179	10.59928	.38714
15	0	2.800	.350	.6601	981.5	1.545	.89146	10.47781	.40849	978.8	1.540	.88874	10.44591	.41396
16	0	3.030	.375	.7072	965.5	1.518	.87694	10.30716	.43722	962.9	1.512	.87625	10.27551	.44241
17	0	3.230	.400	.7544	949.5	1.490	.86242	10.13651	.46674	948.5	1.487	.86120	10.12214	.46701
18	0	3.400	.425	.8015	928.8	1.454	.84355	9.91467	.49906	927.7	1.451	.84235	9.90061	.50119
19	0	3.600	.450	.8487	904.8	1.412	.82177	9.65870	.53706	903.8	1.410	.82060	9.64500	.53906
20	0	3.830	.475	.8958	869.6	1.351	.78983	9.28327	.59049	868.6	1.348	.78871	9.27011	.59233
21	0	4.000	.500	.9430	816.9	1.259	.74191	8.72013	.66721	814.4	1.254	.73941	8.69073	.67114
22	180	.200	.025	.0471	1087.4	1.730	.98764	11.60826	.13343	1088.6	1.731	.98843	11.61757	.12905
23	180	.430	.050	.0943	1081.0	1.719	.98184	11.54007	.16204	1080.6	1.717	.98117	11.53227	.16501
24	180	.600	.075	.1414	1074.6	1.707	.97603	11.47189	.18648	1075.8	1.709	.97682	11.48109	.18336
25	180	.800	.100	.1886	1069.8	1.699	.97168	11.42075	.20299	1069.4	1.698	.97101	11.41285	.20543
26	180	1.000	.125	.2357	1061.9	1.685	.96443	11.33552	.22805	1063.0	1.687	.96521	11.34462	.22549
27	180	1.230	.150	.2829	1057.1	1.677	.96008	11.28438	.24194	1055.0	1.673	.95795	11.25932	.24850
28	180	1.430	.175	.3300	1049.1	1.663	.95283	11.19915	.26364	1047.1	1.659	.95059	11.17402	.26974
30	180	1.800	.225	.4243	1033.1	1.635	.93833	11.02870	.30293	1034.3	1.637	.93908	11.03754	.30100
31	180	2.000	.250	.4715	1025.1	1.621	.93108	10.94347	.32104	1026.3	1.623	.93182	10.95225	.31922
32	180	2.230	.275	.5186	1017.1	1.607	.92382	10.85824	.33835	1015.1	1.603	.92166	10.83283	.34337
33	180	2.400	.300	.5658	1006.0	1.588	.91367	10.73892	.36146	1007.1	1.589	.91441	10.74753	.35983
34	180	2.600	.325	.6129	996.4	1.571	.90497	10.63664	.38039	995.9	1.570	.90425	10.62811	.38194
35	180	2.830	.350	.6601	983.6	1.549	.89337	10.50027	.40460	983.1	1.548	.89263	10.49164	.40610
36	180	3.000	.375	.7072	970.8	1.527	.88177	10.36391	.42781	971.9	1.528	.88247	10.37222	.42642
37	180	3.200	.400	.7544	953.3	1.496	.86581	10.17660	.45840	954.3	1.498	.86651	10.18456	.45710
38	180	3.430	.425	.8015	934.1	1.463	.84841	9.97185	.49035	935.2	1.464	.84909	9.97985	.48913
39	180	3.600	.450	.8487	908.6	1.418	.82521	9.69912	.53116	909.6	1.420	.82587	9.70690	.53002
40	180	3.800	.475	.8958	876.6	1.363	.79620	9.35820	.58001	877.6	1.364	.79684	9.36571	.57895
41	180	4.000	.500	.9430	822.3	1.268	.74689	8.77864	.65938	823.3	1.269	.74749	8.78568	.65844
42	270	1.030	.125	.2357	1068.2	1.696	.97023	11.40371	.20822	1067.8	1.695	.96956	11.39579	.21061
43	270	2.000	.250	.4715	1031.5	1.632	.93688	11.01165	.30663	1031.1	1.631	.93618	11.00342	.30840
44	270	3.000	.375	.7072	977.2	1.538	.88757	10.43209	.41632	979.9	1.542	.88973	10.45752	.41198
45	270	4.000	.500	.9430	830.3	1.282	.75414	8.86387	.64792	834.4	1.289	.75765	8.90510	.64235
46	90	1.000	.125	.2357	1058.2	1.679	.96115	11.29692	.23860	1058.7	1.679	.96124	11.29794	.23833
47	90	2.000	.250	.4715	1019.9	1.612	.92630	10.88737	.33252	1023.3	1.612	.92644	10.88897	.33219
48	90	3.000	.375	.7072	963.9	1.515	.87549	10.29010	.44002	962.9	1.512	.87425	10.27551	.44241
49	90	4.000	.500	.9430	816.9	1.259	.74191	8.72013	.66721	817.6	1.260	.74231	8.72481	.66659

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE II.- DATA[a] FOR 140° CONE; $M_\infty = 2.96$ - Continued

(b) $\alpha = 5°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 3244.0 psf					Φ = 22.5°, p_t = 3241.6 psf					Φ = 45.0°, p_t = 3242.5 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1073.2	1.703	.97358	11.44302	.19596	1074.7	1.707	.97568	11.46773	.18787	1073.1	1.703	.97396	11.44751	.19451
2	0	.230	.025	.0471	1055.6	1.672	.95764	11.25570	.24943	1058.7	1.679	.96118	11.29733	.23849	1060.3	1.681	.96237	11.31123	.23474
3	0	.430	.050	.0943	1050.8	1.666	.95330	11.20462	.26229	1052.4	1.668	.95538	11.22918	.25618	1055.5	1.673	.95802	11.26013	.24879
4	0	.630	.075	.1414	1041.2	1.647	.94460	11.10245	.28650	1044.4	1.654	.94814	11.14398	.27688	1049.2	1.662	.95222	11.19199	.26539
5	0	.800	.100	.1886	1033.3	1.633	.93736	11.01731	.30561	1036.4	1.640	.94089	11.05878	.29632	1039.6	1.645	.94352	11.08978	.28938
6	0	1.300	.125	.2357	1025.3	1.619	.93011	10.93217	.32338	1028.4	1.626	.93364	10.97358	.31474	1033.2	1.634	.93773	11.02164	.30447
7	0	1.230	.150	.2829	1015.7	1.603	.92142	10.83000	.34393	1020.4	1.612	.92639	10.88838	.33231	1025.2	1.620	.93048	10.93646	.32249
8	0	1.430	.175	.3300	1009.3	1.592	.91563	10.76188	.35710	1012.4	1.598	.91914	10.80318	.34916	1017.2	1.606	.92323	10.85129	.33973
9	0	1.630	.200	.3772	999.7	1.575	.90693	10.65971	.37619	1002.8	1.582	.91044	10.70096	.36858	1009.2	1.592	.91599	10.76611	.35630
10	0	1.800	.225	.4243	991.7	1.561	.89969	10.57457	.39155	994.9	1.568	.90319	10.61575	.38418	1001.3	1.578	.90874	10.68094	.37228
11	0	2.030	.250	.4715	982.2	1.544	.89100	10.47240	.40942	985.3	1.551	.89450	10.51351	.40230	991.7	1.562	.90004	10.57873	.39081
12	0	2.230	.275	.5186	971.0	1.525	.88086	10.35320	.42960	975.7	1.534	.88580	10.41127	.41945	982.1	1.545	.89135	10.47652	.40871
13	0	2.430	.300	.5658	961.4	1.508	.87216	10.25103	.44639	966.1	1.518	.87710	10.30903	.43691	972.5	1.528	.88265	10.37431	.42607
14	0	2.630	.325	.6129	950.2	1.489	.86202	10.13184	.46548	954.9	1.498	.86695	10.18975	.45627	961.3	1.509	.87251	10.25506	.44574
15	0	2.800	.350	.6601	937.4	1.467	.85043	9.99561	.48671	942.2	1.476	.85535	10.05343	.47777	948.6	1.487	.86091	10.11878	.46756
16	0	3.000	.375	.7072	923.1	1.442	.83739	9.84236	.50995	927.8	1.451	.84230	9.90008	.50127	934.2	1.462	.84787	9.96547	.49133
17	0	3.200	.400	.7544	905.5	1.411	.82146	9.65504	.53760	910.2	1.421	.82636	9.71264	.52918	916.6	1.431	.83192	9.77808	.51953
18	0	3.400	.425	.8015	887.9	1.381	.80552	9.46773	.56453	889.5	1.384	.80751	9.49112	.56120	897.5	1.398	.81453	9.57366	.54938
19	0	3.600	.450	.8487	864.0	1.339	.78379	9.21231	.60035	867.1	1.346	.78721	9.25257	.59477	873.5	1.356	.79279	9.31814	.58562
20	0	3.830	.475	.8958	830.4	1.281	.75336	8.85471	.64915	833.6	1.287	.75677	8.89473	.64375	840.0	1.298	.76236	8.96040	.63486
21	0	4.000	.500	.9430	780.9	1.195	.70845	8.32684	.71934	784.1	1.201	.71183	8.36650	.71412	787.3	1.206	.71453	8.39825	.70993
22	180	.200	.025	.0471	1092.0	1.735	.99061	11.64325	.11614	1090.7	1.735	.99018	11.63813	.11883	1085.5	1.725	.98520	11.57961	.14610
23	180	.400	.050	.0943	1092.0	1.735	.99061	11.64325	.11614	1090.7	1.735	.99018	11.63813	.11883	1085.5	1.725	.98520	11.57961	.14610
24	180	.630	.075	.1414	1092.0	1.735	.99061	11.64325	.11614	1087.5	1.729	.98728	11.60405	.13536	1082.3	1.719	.98230	11.54550	.15994
25	180	.800	.100	.1886	1088.8	1.730	.98771	11.60916	.13301	1084.3	1.723	.98438	11.56997	.15014	1077.5	1.711	.97795	11.49434	.17878
26	180	1.000	.125	.2357	1085.6	1.724	.99481	11.57506	.14802	1079.5	1.715	.98003	11.51885	.17000	1072.7	1.703	.97359	11.44318	.19591
27	180	1.230	.150	.2829	1079.2	1.713	.97901	11.50687	.17434	1076.3	1.710	.97713	11.48477	.18210	1066.3	1.692	.96779	11.37496	.21678
28	180	1.400	.175	.3300	1076.0	1.708	.97611	11.47278	.18618	1071.5	1.701	.97278	11.43365	.19894	1063.1	1.686	.96489	11.34086	.22655
29	180	1.800	.225	.4243	1053.2	1.685	.96451	11.33640	.22780	1353.3	1.682	.96243	11.31437	.23388	1050.3	1.664	.95328	11.20442	.26234
30	180	2.000	.250	.4715	1058.4	1.677	.96016	11.28526	.24171	1053.9	1.671	.95683	11.24622	.25186	1043.9	1.653	.94747	11.13621	.27870
31	180	2.200	.275	.5186	1050.4	1.663	.95290	11.20002	.26342	1045.0	1.657	.94959	11.16102	.27285	1035.9	1.639	.94022	11.05094	.29806
32	180	2.400	.300	.5658	1044.0	1.652	.94710	11.13183	.27972	1038.0	1.643	.94234	11.07582	.29252	1026.3	1.622	.93151	10.94862	.31997
33	180	2.600	.325	.6129	1034.4	1.635	.93840	11.02955	.30275	1028.4	1.626	.93364	10.97358	.31474	1016.8	1.605	.92281	10.84629	.34072
34	180	2.800	.350	.6601	1023.2	1.616	.92925	10.91022	.32788	1317.2	1.607	.92349	10.85430	.33913	1305.6	1.586	.91265	10.72691	.36372
35	180	3.000	.375	.7072	1010.4	1.594	.91664	10.77384	.35482	1006.4	1.585	.91189	10.71798	.36540	992.8	1.564	.90104	10.59048	.38871
36	180	3.230	.400	.7544	996.0	1.569	.90359	10.62042	.38333	990.1	1.560	.89884	10.56463	.39331	976.8	1.536	.88653	10.41994	.41838
37	180	3.430	.425	.8015	976.9	1.535	.88619	10.41585	.41908	970.9	1.526	.88145	10.36015	.42844	957.6	1.503	.86912	10.21530	.45217
38	180	3.600	.450	.8487	952.9	1.494	.85443	10.16014	.46099	947.0	1.484	.85970	10.10455	.46978	933.6	1.461	.84736	9.95949	.49224
39	180	3.800	.475	.8958	919.3	1.435	.83397	9.80215	.51595	913.4	1.426	.82926	9.74672	.52416	901.6	1.405	.81834	9.61841	.54292
40	180	4.000	.500	.9430	863.3	1.338	.78321	9.20550	.60129	857.5	1.329	.77852	9.15033	.60891	845.7	1.308	.76756	9.02152	.62655
41	270	1.000	.125	.2357	1058.4	1.677	.96016	11.28526	.24171	1058.3	1.696	.96988	11.39957	.20947	1075.9	1.708	.97649	11.47729	.18465
42	270	2.000	.250	.4715	1021.6	1.613	.92680	10.89317	.33134	1034.8	1.637	.93944	11.04174	.30008	1047.1	1.658	.95038	11.17032	.27063
43	270	3.000	.375	.7072	967.3	1.519	.87748	10.31357	.43616	983.7	1.548	.89305	10.49647	.40526	997.6	1.572	.90540	10.64164	.37948
44	270	4.000	.500	.9430	825.0	1.271	.74840	8.79616	.65700	840.0	1.298	.76257	8.96289	.63453	853.7	1.322	.77481	9.10679	.61489
45	90	1.000	.125	.2357	1047.6	1.658	.95040	11.17056	.27057	1039.6	1.646	.94379	11.09286	.28868	1031.6	1.631	.93628	11.00460	.30814
46	90	2.000	.250	.4715	1010.9	1.594	.91708	10.77891	.35384	1001.3	1.579	.90899	10.68390	.37173	990.1	1.559	.89859	10.56169	.39383
47	90	3.000	.375	.7072	956.6	1.500	.86782	10.19995	.45663	945.4	1.482	.85825	10.08751	.47245	932.6	1.459	.84642	9.94843	.49393
48	90	4.000	.500	.9430	812.9	1.250	.73743	8.66740	.67425	801.6	1.232	.72777	8.55394	.68934	790.5	1.212	.71743	8.43232	.70544

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE II.- DATA[a] FOR 140° CONE; $M_\infty = 2.96$ - Continued

(b) $\alpha = 5°$ - Concluded

Orifice	e, deg	s, in.	s/D	s/s*	$\Phi = 67.5°$, $p_t = 3242.9$ psf					$\Phi = 90.0°$, $p_t = 3240.1$ psf				
					p_t, psf	C_p	$p_t/p_{t,2}$	p_t/p_∞	M_t	p_t, psf	C_p	$p_t/p_{t,2}$	p_t/p_∞	M_t
1	0	.030	.000	.0000	1073.0	1.703	.97377	11.44531	.19522	1073.0	1.705	.97461	11.45520	.19201
2	0	.230	.025	.0471	1065.1	1.689	.96653	11.36015	.22107	1059.8	1.699	.97171	11.42110	.20288
3	0	.430	.050	.0943	1058.7	1.678	.96073	11.29207	.23991	1065.1	1.691	.96736	11.36996	.21824
4	0	.630	.075	.1414	1053.9	1.670	.95638	11.24093	.25321	1060.3	1.682	.96301	11.31883	.23266
5	0	.830	.100	.1886	1049.1	1.661	.95204	11.18983	.26592	1055.5	1.674	.95866	11.26769	.24633
6	0	1.030	.125	.2357	1041.1	1.648	.94479	11.10467	.28599	1050.7	1.666	.95431	11.21655	.25934
7	0	1.230	.150	.2829	1033.1	1.634	.93755	11.01951	.30493	1042.7	1.652	.94706	11.13131	.27984
8	0	1.400	.175	.3300	1026.7	1.623	.93175	10.95139	.31940	1036.3	1.641	.94126	11.06313	.29536
9	0	1.600	.200	.3772	1018.7	1.609	.92450	10.86623	.33676	1029.9	1.630	.93546	10.99494	.31021
10	0	1.830	.225	.4243	1010.8	1.595	.91726	10.78107	.35343	1023.5	1.619	.92965	10.92676	.32449
11	0	2.000	.250	.4715	1001.2	1.578	.90857	10.67888	.37266	1014.0	1.602	.92095	10.82448	.34501
12	0	2.230	.275	.5186	993.2	1.564	.90132	10.59372	.38813	1006.0	1.588	.91370	10.73925	.36140
13	0	2.400	.300	.5658	983.6	1.548	.89263	10.49153	.40612	996.4	1.571	.90500	10.63697	.38033
14	0	2.630	.325	.6129	972.4	1.528	.88248	10.37231	.42641	985.2	1.552	.89485	10.51764	.40158
15	0	2.800	.350	.6601	959.7	1.506	.87089	10.23605	.44882	972.4	1.530	.88324	10.38127	.42491
16	0	3.000	.375	.7072	943.7	1.478	.85640	10.06574	.47585	958.1	1.505	.87019	10.22785	.45014
17	0	3.230	.400	.7544	929.3	1.453	.84336	9.91245	.49940	942.1	1.477	.85569	10.05739	.47715
18	0	3.400	.425	.8015	908.6	1.417	.82452	9.69104	.53234	921.3	1.441	.83683	9.83579	.51094
19	0	3.600	.450	.8487	884.6	1.375	.80278	9.43556	.56910	899.0	1.402	.81653	9.59714	.54599
20	0	3.800	.475	.8958	851.1	1.317	.77235	9.07790	.61885	863.9	1.341	.78462	9.22212	.59899
21	0	4.000	.500	.9430	796.8	1.223	.72308	8.49882	.69665	809.6	1.246	.73531	8.64254	.67757
22	180	.200	.025	.0471	1079.0	1.714	.97921	11.50917	.17352	1075.8	1.710	.97715	11.48499	.18202
23	180	.430	.050	.0943	1075.8	1.708	.97631	11.47507	.18540	1069.4	1.698	.97134	11.41673	.20423
24	180	.630	.075	.1414	1072.6	1.702	.97340	11.44097	.19661	1064.6	1.690	.96699	11.36553	.21952
25	180	.800	.100	.1886	1067.8	1.694	.96905	11.38982	.21240	1059.8	1.682	.96263	11.31434	.23389
26	180	1.000	.125	.2357	1063.0	1.686	.96470	11.33867	.22717	1053.4	1.671	.95682	11.24608	.25190
27	180	1.200	.150	.2829	1058.2	1.677	.96035	11.28752	.24111	1047.1	1.659	.95101	11.17781	.26883
28	180	1.430	.175	.3300	1051.8	1.666	.95455	11.21931	.25865	1039.1	1.646	.94376	11.09249	.28877
30	180	1.630	.225	.4243	1037.5	1.641	.94149	11.06586	.29475	1026.3	1.623	.93214	10.95596	.31844
31	180	2.000	.250	.4715	1031.1	1.630	.93569	10.99766	.30963	1018.3	1.609	.92488	10.87064	.33588
32	180	2.230	.275	.5186	1023.1	1.616	.92843	10.91240	.32744	1010.3	1.595	.91762	10.78531	.35261
33	180	2.400	.300	.5658	1013.5	1.600	.91973	10.81010	.34782	999.1	1.576	.90746	10.66585	.37506
34	180	2.630	.325	.6129	1003.9	1.583	.91103	10.70780	.36730	989.5	1.559	.89875	10.56346	.39352
35	180	2.800	.350	.6601	991.1	1.561	.89942	10.57139	.39211	975.7	1.537	.88713	10.42694	.41720
36	180	3.000	.375	.7072	978.3	1.538	.88781	10.43499	.41583	963.9	1.515	.87551	10.29041	.43997
37	180	3.200	.400	.7544	963.9	1.513	.87476	10.28153	.44142	947.9	1.487	.86100	10.11976	.46738
38	180	3.430	.425	.8015	943.1	1.477	.85590	10.05987	.47676	928.8	1.454	.84357	9.91498	.49902
39	180	3.600	.450	.8487	919.2	1.436	.83414	9.80411	.51566	903.2	1.409	.82034	9.64193	.53950
40	180	3.800	.475	.8958	887.2	1.380	.80513	9.46310	.56519	872.8	1.356	.79275	9.31769	.58569
41	180	4.000	.500	.9430	831.2	1.283	.75435	8.86633	.64759	818.5	1.262	.74339	8.73747	.66490
42	270	1.000	.125	.2357	1082.2	1.719	.98211	11.54328	.16080	1085.4	1.726	.98586	11.58738	.14277
43	270	2.000	.250	.4715	1055.0	1.672	.95765	11.25362	.25002	1059.8	1.682	.96263	11.31434	.23389
44	270	3.000	.375	.7072	1007.1	1.598	.91393	10.74190	.36090	1011.9	1.598	.91907	10.80238	.34932
45	270	4.000	.500	.9430	863.2	1.368	.78337	9.20734	.60104	861.0	1.368	.78840	9.26649	.59283
46	90	1.000	.125	.2357	1025.7	1.623	.93175	10.95139	.31940	1025.1	1.621	.93111	10.94380	.32097
47	90	2.000	.250	.4715	985.2	1.550	.89407	10.50856	.40316	992.0	1.546	.89195	10.48355	.40750
48	90	3.000	.375	.7072	924.5	1.445	.83901	9.86136	.50711	922.9	1.443	.83828	9.85283	.50838
49	90	4.000	.500	.9430	785.6	1.203	.71294	8.37960	.71239	782.4	1.199	.71066	8.35275	.71593

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE II.- DATA[a] FOR 140° CONE; M_∞ = 2.96 - Continued

(c) α = 10°

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 3244.1 psf					Φ = 22.5°, p_t = 3243.0 psf					Φ = 45.0°, p_t = 3242.6 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1038.1	1.642	.94168	11.06805	.29426	1038.0	1.642	.94193	11.07104	.29359	1038.0	1.642	.94205	11.07240	.29329
2	0	.200	.025	.0471	1006.1	1.586	.91270	10.72750	.36361	1007.6	1.589	.91440	10.74742	.35985	1012.4	1.598	.91886	10.79985	.34981
3	0	.400	.050	.0943	1004.5	1.583	.91125	10.71047	.36640	1006.0	1.587	.91295	10.73039	.36307	1007.6	1.590	.91451	10.74875	.35960
4	0	.630	.075	.1414	998.1	1.572	.90546	10.64236	.37935	999.7	1.575	.90715	10.66226	.37572	1002.8	1.581	.91016	10.69764	.36919
5	0	.830	.100	.1886	991.7	1.561	.89966	10.57425	.39161	991.7	1.562	.89991	10.57710	.39110	996.5	1.570	.90436	10.62951	.38169
6	0	1.030	.125	.2357	982.2	1.544	.89097	10.47208	.40948	982.1	1.545	.89121	10.47490	.40899	990.1	1.559	.89857	10.56137	.39389
7	0	1.200	.150	.2829	972.6	1.528	.88228	10.36991	.42681	974.1	1.531	.88397	10.38974	.42348	982.1	1.545	.89132	10.47620	.40877
8	0	1.430	.175	.3300	967.8	1.519	.87793	10.31883	.43530	964.5	1.514	.87527	10.28755	.44044	974.1	1.531	.88407	10.39102	.42327
9	0	1.600	.200	.3772	956.6	1.500	.86779	10.19964	.45468	958.1	1.503	.86947	10.21942	.45150	966.1	1.517	.87683	10.30585	.43743
10	0	1.830	.225	.4243	948.6	1.486	.86055	10.11450	.46821	950.2	1.489	.86223	10.13426	.46509	958.1	1.503	.86958	10.22068	.45130
11	0	2.000	.250	.4715	940.6	1.472	.85330	10.02936	.48150	940.6	1.473	.85353	10.03206	.48108	948.6	1.487	.86089	10.11847	.46759
12	0	2.200	.275	.5186	931.1	1.456	.84461	9.92719	.49716	931.0	1.456	.84484	9.92987	.49676	940.6	1.473	.85364	10.03330	.48089
13	0	2.400	.300	.5658	921.5	1.439	.83592	9.82502	.51255	921.4	1.439	.83514	9.82767	.51215	929.4	1.453	.84349	9.91406	.49916
14	0	2.600	.325	.6129	908.7	1.417	.82433	9.68880	.53267	910.2	1.420	.82600	9.70845	.52979	919.8	1.437	.83480	9.81185	.51451
15	0	2.830	.350	.6601	897.5	1.397	.81419	9.56961	.54996	899.1	1.400	.81586	9.58922	.54714	907.0	1.415	.82320	9.67558	.53460
16	0	3.000	.375	.7072	884.7	1.375	.80260	9.43339	.56941	884.7	1.375	.80281	9.43593	.56905	895.9	1.395	.81306	9.55633	.55187
17	0	3.200	.400	.7544	868.8	1.347	.78811	9.26311	.59330	867.1	1.345	.78687	9.24857	.59532	879.9	1.367	.79857	9.38599	.57610
18	0	3.400	.425	.8015	851.2	1.317	.77217	9.07580	.61914	849.5	1.314	.77093	9.06122	.62113	863.7	1.334	.78117	9.18158	.60460
19	0	3.630	.450	.8487	828.8	1.278	.75189	8.83741	.65148	828.8	1.278	.75209	8.83980	.65116	838.4	1.295	.76088	8.94309	.63721
20	0	3.800	.475	.8958	796.9	1.222	.72292	8.49686	.69691	795.8	1.223	.72311	8.49915	.69660	806.4	1.240	.73190	8.60240	.68291
21	0	4.000	.500	.9430	752.2	1.145	.68235	8.02008	.75957	750.5	1.142	.68109	8.00521	.76151	758.5	1.156	.68842	8.09137	.75024
22	180	.200	.025	.0471	1076.0	1.708	.97608	11.47242	.18630	1071.5	1.700	.97236	11.42872	.20050	1063.1	1.686	.96686	11.34051	.22665
23	180	.430	.050	.0943	1090.4	1.733	.98913	11.62584	.12503	1084.3	1.723	.98395	11.56498	.15219	1069.5	1.697	.97066	11.40872	.20669
24	180	.600	.075	.1414	1093.6	1.738	.99203	11.65994	.10695	1089.1	1.731	.98830	11.61607	.12975	1074.3	1.705	.97501	11.45988	.19047
25	180	.800	.100	.1886	1095.2	1.741	.99348	11.67698	.09668	1089.1	1.731	.98830	11.61607	.12976	1074.3	1.705	.97501	11.45988	.19047
26	180	1.000	.125	.2357	1095.2	1.741	.99348	11.67698	.09668	1089.1	1.731	.98830	11.61607	.12976	1072.7	1.703	.97356	11.44283	.19602
27	180	1.200	.150	.2829	1093.6	1.738	.99203	11.65994	.10695	1087.5	1.728	.98695	11.59904	.13763	1069.5	1.697	.97066	11.40872	.20669
28	180	1.430	.175	.3300	1092.0	1.735	.99058	11.64289	.11633	1086.3	1.723	.98395	11.56498	.15219	1066.3	1.692	.96776	11.37461	.21688
29	180	1.600	.200	.3772	1084.0	1.721	.98333	11.55766	.15514	1077.9	1.712	.97816	11.49685	.17790	1056.7	1.675	.95905	11.27229	.24512
30	180	1.830	.225	.4243	1080.8	1.716	.98043	11.52356	.16826	1073.1	1.703	.97381	11.44575	.19508	1051.9	1.667	.95470	11.22113	.25820
31	180	2.000	.250	.4715	1076.0	1.708	.97608	11.47242	.18630	1068.7	1.692	.96801	11.37762	.21600	1045.5	1.655	.94890	11.15292	.27477
32	180	2.230	.275	.5186	1068.0	1.694	.96883	11.38719	.21318	1060.3	1.681	.96222	11.30949	.23521	1037.5	1.642	.94164	11.06765	.29435
33	180	2.400	.300	.5658	1062.0	1.680	.96158	11.30196	.23725	1053.9	1.670	.95642	11.24136	.25310	1029.5	1.628	.93439	10.98238	.31288
34	180	2.600	.325	.6129	1050.4	1.663	.95287	11.19968	.26351	1042.8	1.650	.94628	11.12213	.28198	1018.4	1.608	.92423	10.86301	.33740
35	180	2.800	.350	.6601	1040.8	1.646	.94417	11.09740	.28765	1031.6	1.631	.93613	11.00291	.30851	1007.2	1.589	.91407	10.74364	.36057
36	180	3.000	.375	.7072	1026.4	1.621	.93112	10.94398	.32094	1015.6	1.603	.92164	10.83258	.34342	992.8	1.564	.90102	10.59016	.38877
37	180	3.200	.400	.7544	1010.4	1.594	.91662	10.77351	.35688	999.7	1.575	.90715	10.66226	.37572	975.2	1.533	.88506	10.40257	.42132
38	180	3.400	.425	.8015	988.0	1.555	.89531	10.53486	.39856	975.7	1.534	.88561	10.40677	.42061	951.2	1.491	.86329	10.14677	.46311
39	180	3.600	.450	.8487	956.1	1.499	.86730	10.19392	.45560	945.4	1.481	.85788	10.08316	.47313	919.2	1.436	.83427	9.80570	.51543
40	180	3.800	.475	.8958	898.5	1.399	.81509	9.58024	.54843	889.5	1.384	.80716	9.48703	.56179	863.3	1.338	.78349	9.20883	.60083
41	180	4.000	.500	.9430	1028.0	1.624	.93257	10.96102	.31738	1050.8	1.664	.95352	11.20730	.26163	1072.7	1.703	.97356	11.44283	.19602
42	270	1.000	.125	.2357	999.2	1.574	.90646	10.65418	.37720	1028.4	1.625	.93324	10.96884	.31574	1055.1	1.672	.95760	11.25524	.24955
43	270	2.000	.250	.4715	951.3	1.491	.86295	10.14278	.46375	982.1	1.545	.89121	10.47490	.40899	1012.0	1.597	.91843	10.79480	.35079
44	270	3.000	.375	.7072	812.2	1.249	.73677	8.65972	.67528	943.2	1.303	.76514	8.99309	.63042	871.3	1.352	.79075	9.29410	.58898
45	270	4.000	.500	.9430	1023.5	1.611	.92574	10.88075	.33385	1001.3	1.578	.90860	10.67929	.37259	990.1	1.559	.89857	10.56137	.39389
46	90	1.000	.125	.2357	991.7	1.561	.89966	10.57425	.39161	965.1	1.517	.87672	10.30458	.43764	950.2	1.490	.86233	10.13551	.46490
47	90	2.000	.250	.4715	940.6	1.472	.85330	10.02936	.48150	911.8	1.423	.82745	9.72548	.52729	895.9	1.395	.81306	9.55633	.55187
48	90	3.000	.375	.7072	801.7	1.231	.72726	8.54794	.69014	777.7	1.189	.70572	8.29476	.72356	763.3	1.165	.69277	8.14247	.74354
49	90	4.000	.500	.9430															

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE II.- DATA[a] FOR 140° CONE; $M_\infty = 2.96$ - Continued

(c) $\alpha = 10°$ - Concluded

Orifice	e, deg	s, in.	s/D	s/s*	$\Phi = 67.5°$, $p_t = 3243.2$ psf					$\Phi = 90.0°$, $p_t = 3240.9$ psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.300	.000	.0000	1036.3	1.639	.94036	11.05255	.29770	1034.7	1.638	.93958	11.04336	.29973
2	0	.230	.025	.0471	1018.7	1.609	.92442	10.86522	.33696	1031.5	1.632	.93668	11.00927	.30716
3	0	.430	.050	.0943	1015.6	1.603	.92152	10.83116	.34370	1028.3	1.626	.93378	10.97519	.31440
4	0	.630	.075	.1414	1010.8	1.595	.91717	10.78007	.35362	1026.7	1.624	.93233	10.95814	.31798
5	0	.800	.100	.1886	1006.0	1.586	.91283	10.72898	.36333	1023.5	1.618	.92943	10.92406	.32505
6	0	1.000	.125	.2357	1001.2	1.578	.90848	10.67789	.37285	1020.3	1.613	.92653	10.88998	.33199
7	0	1.200	.150	.2829	994.8	1.567	.90269	10.60977	.38525	1015.6	1.604	.92218	10.83885	.34219
8	0	1.400	.175	.3300	988.4	1.556	.89689	10.54165	.39737	1010.8	1.596	.91783	10.78772	.35215
9	0	1.630	.200	.3772	980.4	1.542	.88964	10.45650	.41215	1004.4	1.585	.91203	10.71955	.36510
10	0	1.800	.225	.4243	974.0	1.531	.88395	10.38838	.42371	998.0	1.574	.90623	10.65138	.37771
11	0	2.000	.250	.4715	967.6	1.520	.87805	10.32026	.43506	991.6	1.563	.90043	10.58322	.39001
12	0	2.230	.275	.5186	958.1	1.503	.86936	10.21808	.45172	983.6	1.549	.89318	10.49800	.40499
13	0	2.430	.300	.5658	948.5	1.486	.86067	10.11590	.46799	974.0	1.532	.88448	10.39575	.42247
14	0	2.630	.325	.6129	938.9	1.470	.85197	10.01372	.48392	964.5	1.515	.87578	10.29350	.43946
15	0	2.830	.350	.6601	926.1	1.447	.84038	9.87748	.50468	953.3	1.496	.86563	10.17420	.45875
16	0	3.000	.375	.7072	913.4	1.425	.82879	9.74123	.52497	940.5	1.474	.85403	10.03787	.48018
17	0	3.200	.400	.7544	897.4	1.397	.81430	9.57093	.54977	924.5	1.446	.83953	9.86744	.50619
18	0	3.400	.425	.8015	878.2	1.364	.79691	9.36657	.57883	907.0	1.415	.82358	9.67998	.53396
19	0	3.630	.450	.8487	855.9	1.325	.77663	9.12815	.61196	883.0	1.374	.80183	9.42435	.57069
20	0	3.800	.475	.8958	823.9	1.270	.74765	8.78755	.65818	849.5	1.315	.77138	9.06646	.62042
21	0	4.000	.500	.9430	772.8	1.181	.70128	8.24258	.73041	796.8	1.224	.72353	8.50407	.69595
22	180	.230	.025	.0471	1051.8	1.666	.95446	11.21878	.25891	1039.1	1.645	.94352	11.08975	.28939
23	180	.430	.050	.0943	1053.4	1.669	.95591	11.23533	.25463	1034.3	1.637	.93917	11.03857	.30078
24	180	.630	.075	.1414	1053.4	1.669	.95591	11.23533	.25463	1034.3	1.637	.93917	11.03857	.30078
25	180	.800	.100	.1886	1051.8	1.666	.95446	11.21828	.25891	1029.5	1.628	.93481	10.98738	.31182
26	180	1.030	.125	.2357	1050.3	1.663	.95301	11.20123	.26313	1026.3	1.623	.93191	10.95326	.31900
27	180	1.230	.150	.2829	1045.5	1.655	.94866	11.15008	.27544	1021.5	1.615	.92755	10.90208	.32954
28	180	1.430	.175	.3300	1042.3	1.649	.94575	11.11598	.28340	1015.1	1.603	.92175	10.83383	.34318
30	180	1.800	.225	.4243	1031.1	1.630	.93560	10.99664	.30985	1003.9	1.584	.91159	10.71440	.36607
31	180	2.000	.250	.4715	1024.7	1.619	.92980	10.92844	.32415	997.5	1.573	.90578	10.64616	.37866
32	180	2.230	.275	.5186	1018.3	1.608	.92400	10.86025	.33795	989.5	1.559	.89852	10.56085	.39398
33	180	2.400	.300	.5658	1010.3	1.594	.91674	10.77500	.35460	981.5	1.545	.89127	10.47555	.40888
34	180	2.600	.325	.6129	1000.7	1.577	.90804	10.67271	.37380	970.3	1.526	.88110	10.35612	.42911
35	180	2.800	.350	.6601	989.5	1.558	.89789	10.55336	.39531	959.1	1.506	.87094	10.23669	.44872
36	180	3.000	.375	.7072	978.3	1.538	.88773	10.43402	.41599	946.3	1.484	.85933	10.10020	.47046
37	180	3.230	.400	.7544	962.3	1.510	.87323	10.26353	.44436	932.0	1.459	.84627	9.94665	.49420
38	180	3.430	.425	.8015	943.1	1.477	.85582	10.05894	.47691	914.4	1.428	.83030	9.75898	.52235
39	180	3.600	.450	.8487	920.8	1.438	.83551	9.82025	.51326	893.4	1.386	.80853	9.50306	.55950
40	180	3.800	.475	.8958	890.4	1.385	.80795	9.49632	.56046	858.4	1.331	.77949	9.16184	.60732
41	180	4.000	.500	.9430	836.0	1.291	.75863	8.91665	.64079	807.3	1.242	.73304	8.61588	.68112
42	270	1.000	.125	.2357	1088.6	1.730	.98782	11.61040	.13243	1095.0	1.742	.99433	11.68689	.09019
43	270	2.000	.250	.4715	1072.6	1.702	.97331	11.43991	.19695	1080.6	1.717	.98126	11.53334	.16460
44	270	3.000	.375	.7072	1031.1	1.630	.93560	10.99664	.30985	1039.1	1.645	.94352	11.08975	.28939
45	270	4.000	.500	.9430	893.6	1.391	.81085	9.53042	.55559	903.2	1.409	.82014	9.63955	.53985
46	90	1.000	.125	.2357	983.6	1.547	.89254	10.49056	.40628	980.4	1.543	.89028	10.46392	.41088
47	90	2.000	.250	.4715	940.5	1.472	.85342	10.03075	.48129	937.3	1.488	.85113	10.00378	.48565
48	90	3.000	.375	.7072	884.6	1.375	.80271	9.43469	.56922	881.4	1.371	.80038	9.40730	.57309
49	90	4.000	.500	.9430	755.3	1.150	.68535	8.05525	.75496	750.5	1.143	.68148	8.00984	.76090

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE II.- DATA[a] FOR 140° CONE; $M_\infty = 2.96$ - Continued

(d) $\alpha = 15°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 3240.4 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.030	.000	.0000	973.6	1.531	.88421	10.39257	.42301
2	0	.230	.025	.0471	930.4	1.456	.84500	9.93181	.49646
3	0	.400	.050	.0943	940.0	1.473	.85372	10.03420	.48075
4	0	.530	.075	.1414	941.6	1.476	.85517	10.05127	.47810
5	0	.830	.100	.1886	935.2	1.465	.84936	9.98301	.48864
6	0	1.000	.125	.2357	927.2	1.451	.84210	9.89768	.50163
7	0	1.200	.150	.2829	919.2	1.437	.83484	9.81236	.51463
8	0	1.400	.175	.3300	912.8	1.426	.82903	9.74410	.52455
9	0	1.600	.200	.3772	904.8	1.412	.82177	9.65877	.53705
10	0	1.800	.225	.4243	896.9	1.398	.81451	9.57345	.54941
11	0	2.000	.250	.4715	888.9	1.384	.80725	9.48812	.56163
12	0	2.200	.275	.5186	880.9	1.370	.80000	9.40280	.57373
13	0	2.400	.300	.5658	871.3	1.353	.79128	9.30041	.58810
14	0	2.600	.325	.6129	850.1	1.334	.78112	9.18095	.60469
15	0	2.800	.350	.6601	848.9	1.314	.77096	9.06150	.62110
16	0	3.000	.375	.7072	836.1	1.292	.75934	8.92498	.63966
17	0	3.200	.400	.7544	823.3	1.270	.74773	8.78846	.65806
18	0	3.400	.425	.8015	807.3	1.242	.73321	8.61781	.69086
19	0	3.600	.450	.8487	798.1	1.209	.71579	8.41303	.70798
20	0	3.830	.475	.8958	761.0	1.161	.69110	8.12293	.74611
21	0	4.000	.500	.9430	719.4	1.089	.65335	7.67924	.80410
22	180	.230	.025	.0471	1031.6	1.632	.93688	11.01174	.30661
23	180	.400	.050	.0943	1056.7	1.694	.96879	11.38675	.21331
24	180	.530	.075	.1414	1079.5	1.716	.98039	11.52312	.16843
25	180	.800	.100	.1886	1087.5	1.730	.98764	11.60835	.13339
26	180	1.030	.125	.2357	1092.3	1.738	.99200	11.65948	.10721
27	180	1.230	.150	.2829	1093.9	1.741	.99345	11.67653	.09697
28	180	1.400	.175	.3300	1095.5	1.744	.99490	11.69358	.08553
30	180	1.830	.225	.4243	1093.9	1.741	.99345	11.67653	.09697
31	180	2.030	.250	.4715	1092.3	1.738	.99200	11.65948	.10721
32	180	2.230	.275	.5186	1090.7	1.735	.99055	11.64244	.11657
33	180	2.430	.300	.5558	1085.9	1.727	.98619	11.59130	.14106
34	180	2.630	.325	.6129	1079.5	1.716	.98039	11.52312	.16843
35	180	2.800	.350	.6601	1074.7	1.707	.97604	11.47198	.18645
36	180	3.000	.375	.7072	1066.7	1.694	.96879	11.38675	.21331
37	180	3.200	.400	.7544	1055.5	1.674	.95864	11.26743	.24639
38	180	3.400	.425	.8015	1041.2	1.649	.94559	11.11401	.28385
39	180	3.630	.450	.8487	1022.0	1.616	.92818	10.90946	.32804
40	180	3.830	.475	.8958	991.7	1.563	.90063	10.58558	.38959
41	180	4.000	.500	.9430	937.4	1.468	.85132	10.00602	.48510
42	270	1.000	.125	.2357	982.1	1.546	.89193	10.48331	.40754
43	270	2.000	.250	.4715	964.5	1.516	.87597	10.29580	.43909
44	270	3.000	.375	.7072	921.4	1.441	.83681	9.83556	.51097
45	270	4.000	.500	.9430	792.1	1.216	.71934	8.45483	.70246
46	90	1.030	.125	.2357	973.6	1.531	.88421	10.39257	.42301
47	90	2.030	.250	.4715	956.0	1.501	.86823	10.20485	.45385
48	90	3.030	.375	.7072	911.2	1.423	.82758	9.72703	.52706
49	90	4.000	.500	.9430	781.7	1.198	.70998	8.34477	.71698

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE II.- DATA[a] FOR 140° CONE; M_∞ = 2.96 - Continued

(e) α = 20°

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 3242.3 psf					Φ = 22.5°, p_t = 3241.6 psf					Φ = 45.0°, p_t = 3242.3 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	882.1	1.371	.80065	9.41049	.57264	883.1	1.373	.80171	9.42297	.57088	881.5	1.370	.80039	9.40389	.57358
2	0	.230	.025	.0471	824.7	1.271	.74853	8.79787	.65680	827.2	1.276	.75097	8.82657	.65294	833.6	1.287	.75661	8.89281	.64401
3	0	.430	.050	.0943	853.2	1.316	.77169	9.07014	.61991	847.9	1.312	.76982	9.04809	.62293	846.4	1.309	.76820	9.02910	.62552
4	0	.630	.075	.1414	861.4	1.335	.78183	9.18926	.60354	855.9	1.326	.77707	9.13329	.61125	854.3	1.323	.77545	9.11428	.61387
5	0	.800	.100	.1886	859.8	1.332	.78038	9.17225	.60589	855.9	1.326	.77707	9.13329	.61125	854.3	1.323	.77545	9.11428	.61387
6	0	1.000	.125	.2357	853.4	1.321	.77459	9.10418	.61525	849.5	1.315	.77127	9.06513	.62060	852.7	1.320	.77400	9.09725	.61620
7	0	1.230	.150	.2829	847.0	1.310	.76880	9.03611	.62456	844.8	1.307	.76692	9.01401	.62758	847.9	1.312	.76965	9.04614	.62319
8	0	1.400	.175	.3300	842.2	1.302	.76445	8.98506	.63152	840.0	1.298	.76257	8.96289	.63453	844.8	1.306	.76675	9.01207	.62784
9	0	1.630	.200	.3772	835.8	1.291	.75866	8.91699	.64075	833.6	1.287	.75677	8.89473	.64375	841.6	1.301	.76385	8.97799	.63248
10	0	1.800	.225	.4243	829.5	1.280	.75287	8.84892	.64993	828.8	1.279	.75242	8.84361	.65065	836.8	1.292	.75950	8.92689	.63941
11	0	2.000	.250	.4715	823.1	1.269	.74708	8.78085	.65908	820.8	1.265	.74517	8.75842	.66209	832.0	1.284	.75516	8.87578	.64631
12	0	2.230	.275	.5186	815.1	1.255	.73984	8.69577	.67047	816.0	1.257	.74082	8.70730	.66893	825.6	1.273	.74936	8.80763	.65549
13	0	2.430	.300	.5658	808.7	1.244	.73405	8.62770	.67956	808.0	1.243	.73357	8.62210	.68029	819.2	1.262	.74356	8.73949	.66463
14	0	2.600	.325	.6129	800.8	1.230	.72681	8.54261	.69085	800.0	1.229	.72617	8.53690	.69160	811.2	1.248	.73631	8.65431	.67600
15	0	2.830	.350	.6601	792.8	1.216	.71957	8.45753	.70211	792.1	1.215	.71908	8.45170	.70288	800.0	1.229	.72617	8.53506	.69185
16	0	3.000	.375	.7072	783.2	1.199	.71088	8.35542	.71558	782.5	1.198	.71038	8.34946	.71636	792.1	1.215	.71892	8.44988	.70312
17	0	3.200	.400	.7544	772.0	1.180	.70075	8.23630	.73124	771.3	1.179	.70023	8.23018	.73704	779.3	1.192	.70732	8.31359	.72108
18	0	3.400	.425	.8015	759.3	1.158	.68917	8.10017	.74909	758.5	1.157	.68863	8.09387	.74991	766.5	1.170	.69573	8.17730	.73898
19	0	3.600	.450	.8487	744.9	1.133	.67614	7.94701	.76912	742.6	1.129	.67413	7.92347	.77219	748.9	1.140	.67979	7.98990	.76351
20	0	3.830	.475	.8958	721.0	1.091	.65442	7.69175	.80246	718.6	1.087	.65239	7.66787	.80558	723.4	1.095	.65659	7.71733	.79912
21	0	4.000	.500	.9430	685.9	1.030	.62257	7.31738	.85146	683.5	1.026	.62049	7.29300	.85466	686.7	1.031	.62326	7.32550	.85039
22	180	.200	.025	.0471	968.8	1.522	.87933	10.33531	.43257	959.2	1.506	.87082	10.23519	.44896	940.6	1.473	.85372	10.03423	.48075
23	180	.400	.050	.0943	1026.3	1.622	.93157	10.94929	.31983	1010.4	1.595	.91726	10.78107	.35343	975.7	1.534	.88561	10.40902	.42023
24	180	.630	.075	.1414	1051.9	1.667	.95479	11.22217	.25794	1035.9	1.639	.94048	11.05401	.29738	996.5	1.570	.90445	10.63049	.38151
25	180	.800	.100	.1886	1066.3	1.692	.96785	11.37567	.21657	1050.3	1.664	.95354	11.20754	.26157	1007.6	1.590	.91459	10.74974	.35941
26	180	1.000	.125	.2357	1075.9	1.708	.97655	11.47799	.18441	1059.9	1.681	.96225	11.30989	.23510	1017.2	1.606	.92329	10.85196	.33960
27	180	1.230	.150	.2829	1083.9	1.722	.98381	11.56327	.15288	1066.3	1.692	.96806	11.37812	.21585	1023.6	1.617	.92909	10.92010	.32586
28	180	1.400	.175	.3300	1090.3	1.733	.98961	11.63149	.12222	1071.1	1.700	.97241	11.42930	.20032	1028.8	1.623	.93199	10.95417	.31881
30	180	1.800	.225	.4243	1095.1	1.742	.99397	11.68265	.09302	1077.5	1.712	.97822	11.49753	.17766	1030.0	1.629	.93489	10.98825	.31164
31	180	2.000	.250	.4715	1095.7	1.745	.99542	11.69971	.08103	1079.1	1.714	.97967	11.51459	.17156	1031.6	1.631	.93634	11.00528	.30800
32	180	2.200	.275	.5186	1098.3	1.747	.99687	11.71676	.06695	1079.1	1.714	.97967	11.51459	.17156	1031.6	1.631	.93634	11.00528	.30800
33	180	2.400	.300	.5658	1098.3	1.747	.99687	11.71676	.06695	1079.1	1.714	.97967	11.51459	.17156	1030.0	1.629	.93489	10.98825	.31164
34	180	2.600	.325	.6129	1098.3	1.747	.99687	11.71676	.06695	1077.5	1.712	.97822	11.49753	.17766	1026.8	1.623	.93199	10.95417	.31881
35	180	2.800	.350	.6601	1095.1	1.742	.99397	11.68265	.09302	1074.3	1.706	.97531	11.46341	.18930	1020.4	1.612	.92619	10.88603	.33279
36	180	3.000	.375	.7072	1090.3	1.733	.98961	11.63149	.12222	1069.5	1.698	.97096	11.41224	.20562	1015.6	1.604	.92184	10.83492	.34296
37	180	3.200	.400	.7544	1082.3	1.720	.98236	11.54621	.15966	1061.5	1.684	.96370	11.32695	.23043	1006.0	1.587	.91314	10.73271	.36263
38	180	3.400	.425	.8015	1071.1	1.700	.97220	11.42683	.20109	1050.3	1.664	.95354	11.20754	.26157	991.7	1.562	.90010	10.57938	.39069
39	180	3.600	.450	.8487	1055.1	1.672	.95769	11.25628	.24928	1032.7	1.634	.93758	11.01989	.30485	974.1	1.531	.88416	10.39199	.42311
40	180	3.830	.475	.8958	1029.5	1.628	.93447	10.98340	.31267	1005.6	1.586	.91291	10.72989	.36316	947.0	1.484	.85952	10.10237	.47012
41	180	4.000	.500	.9430	978.4	1.539	.88804	10.43764	.41537	954.4	1.497	.86646	10.18402	.45719	895.9	1.395	.81313	9.55722	.55174
42	270	1.000	.125	.2357	912.8	1.425	.82855	9.73839	.52539	965.6	1.517	.87662	10.30343	.43783	1020.4	1.612	.92619	10.88603	.33279
43	270	2.000	.250	.4715	908.0	1.416	.82419	9.68722	.53290	970.4	1.525	.88098	10.35460	.42936	1034.8	1.637	.93923	11.03935	.30061
44	270	3.000	.375	.7072	877.7	1.364	.79662	9.36318	.57931	946.4	1.484	.85921	10.09872	.47069	1018.8	1.609	.92474	10.86899	.33620
45	270	4.000	.500	.9430	761.0	1.161	.69070	8.11817	.74673	826.5	1.275	.75035	8.81932	.65392	902.2	1.406	.81893	9.62536	.54191
46	90	1.000	.125	.2357	902.8	1.407	.81947	9.63171	.54099	867.1	1.346	.78721	9.25257	.59477	852.7	1.320	.77400	9.09725	.61623
47	90	2.000	.250	.4715	898.1	1.399	.81513	9.58066	.54837	854.3	1.323	.77562	9.11625	.61359	833.4	1.281	.75371	8.85874	.64861
48	90	3.000	.375	.7072	865.2	1.344	.78617	9.24031	.59647	817.6	1.259	.74227	8.72434	.66665	792.1	1.215	.71892	8.44988	.70312
49	90	4.000	.500	.9430	749.7	1.141	.68048	7.99806	.76244	707.4	1.068	.64224	7.54860	.82117	689.9	1.037	.62616	7.35957	.84592

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE II.- DATA[a] FOR 140° CONE; $M_\infty = 2.96$ - Concluded

(e) $\alpha = 20°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 3244.3 psf					Φ = 90.0°, p_t = 3242.1 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	879.8	1.366	.79809	9.38042	.57688	879.8	1.367	.79863	9.38679	.57599
2	0	.200	.025	.0471	869.5	1.316	.77057	9.05696	.62172	875.0	1.359	.79428	9.33568	.58317
3	0	.400	.050	.0943	855.9	1.325	.77636	9.12505	.61239	883.0	1.373	.80153	9.42086	.57118
4	0	.600	.075	.1414	863.9	1.339	.78361	9.21018	.60065	882.6	1.390	.81023	9.52307	.55664
5	0	.800	.100	.1886	865.5	1.341	.78506	9.22720	.59829	899.0	1.401	.81603	9.59122	.54685
6	0	1.000	.125	.2357	865.5	1.341	.78506	9.22720	.59829	902.2	1.406	.81892	9.62529	.54192
7	0	1.200	.150	.2829	865.5	1.341	.78506	9.22720	.59829	903.8	1.409	.82037	9.64232	.53945
8	0	1.400	.175	.3300	863.9	1.339	.78361	9.21018	.60065	903.8	1.409	.82037	9.64232	.53945
9	0	1.630	.200	.3772	862.3	1.336	.78216	9.19315	.60300	902.2	1.406	.81892	9.62529	.54192
10	0	1.830	.225	.4243	857.5	1.328	.77781	9.14208	.61004	900.6	1.404	.81748	9.60825	.54439
11	0	2.000	.250	.4715	852.7	1.319	.77347	9.09101	.61706	899.0	1.401	.81603	9.59122	.54685
12	0	2.200	.275	.5186	847.9	1.311	.76912	9.03993	.62404	895.8	1.395	.81313	9.55714	.55175
13	0	2.400	.300	.5658	841.5	1.300	.76333	8.97186	.63331	889.4	1.384	.80733	9.48900	.56151
14	0	2.600	.325	.6129	835.1	1.289	.75754	8.90376	.64254	883.0	1.373	.80153	9.42086	.57118
15	0	2.830	.350	.6601	827.1	1.275	.75029	8.81862	.65401	875.0	1.359	.79428	9.33568	.58317
16	0	3.000	.375	.7072	817.6	1.258	.74160	8.71647	.66770	865.5	1.342	.78559	9.23346	.59742
17	0	3.230	.400	.7544	804.8	1.236	.73001	8.58028	.68585	852.7	1.320	.77399	9.09717	.61621
18	0	3.400	.425	.8015	790.4	1.211	.71698	8.42706	.70613	838.3	1.295	.76095	8.94385	.63711
19	0	3.600	.450	.8487	772.8	1.180	.70105	8.23979	.73078	820.7	1.265	.74500	8.75646	.66235
20	0	3.800	.475	.8958	745.7	1.133	.67642	7.95037	.76868	792.0	1.215	.71891	8.44981	.70313
21	0	4.000	.500	.9430	702.6	1.058	.63731	7.49072	.82874	744.1	1.131	.67543	7.93873	.77020
22	180	.200	.025	.0471	911.8	1.422	.82706	9.72091	.52796	884.0	1.375	.80242	9.43132	.56970
23	180	.400	.050	.0943	929.3	1.452	.84299	9.90818	.50005	887.2	1.380	.80532	9.46543	.56486
24	180	.600	.075	.1414	945.3	1.480	.85748	10.07842	.47387	898.4	1.400	.81548	9.58482	.54777
25	180	.800	.100	.1886	954.9	1.497	.86617	10.18056	.45774	903.2	1.408	.81983	9.63598	.54037
26	180	1.000	.125	.2357	961.3	1.508	.87196	10.24866	.44678	908.0	1.416	.82419	9.68715	.53291
27	180	1.200	.150	.2829	964.5	1.514	.87486	10.28271	.44123	909.6	1.419	.82564	9.70420	.53042
28	180	1.400	.175	.3300	967.6	1.519	.87776	10.31676	.43564	909.6	1.419	.82564	9.70420	.53042
30	180	1.800	.225	.4243	967.6	1.519	.87776	10.31676	.43564	908.0	1.416	.82419	9.68715	.53291
31	180	2.000	.250	.4715	967.6	1.519	.87776	10.31676	.43564	904.8	1.411	.82129	9.65304	.53789
32	180	2.230	.275	.5186	964.5	1.514	.87486	10.28271	.44123	903.2	1.408	.81983	9.63598	.54037
33	180	2.400	.300	.5658	959.7	1.505	.87051	10.23164	.44953	898.4	1.400	.81548	9.58482	.54777
34	180	2.630	.325	.6129	956.5	1.500	.86762	10.19759	.45501	872.0	1.389	.80968	9.51660	.55757
35	180	2.800	.350	.6601	953.1	1.489	.86182	10.12949	.46585	884.0	1.375	.80242	9.43132	.56970
36	180	3.000	.375	.7072	942.1	1.475	.85458	10.04437	.47917	874.4	1.358	.79372	9.32900	.58410
37	180	3.200	.400	.7544	932.5	1.458	.84589	9.94222	.49488	863.2	1.339	.78356	9.20961	.60072
38	180	3.400	.425	.8015	918.1	1.433	.83285	9.78900	.51791	848.8	1.314	.77050	9.05612	.62183
39	180	3.600	.450	.8487	899.0	1.400	.81547	9.58471	.54779	828.1	1.277	.75164	8.83441	.65189
40	180	3.800	.475	.8958	870.2	1.350	.78940	9.27827	.59119	802.5	1.233	.72842	8.56153	.68834
41	180	4.000	.500	.9430	820.7	1.264	.74450	8.75052	.66315	756.1	1.152	.68634	8.06694	.75344
42	270	1.000	.125	.2357	1061.9	1.683	.96321	11.32120	.23201	1075.8	1.708	.97655	11.47791	.18444
43	270	2.000	.250	.4715	1082.6	1.719	.98204	11.54251	.16110	1096.6	1.745	.99541	11.69962	.08109
44	270	3.000	.375	.7072	1071.4	1.700	.97190	11.42334	.20218	1091.8	1.736	.99136	11.64845	.11336
45	270	4.000	.500	.9430	961.3	1.508	.87196	10.24866	.44678	981.5	1.544	.89094	10.47167	.40955
46	90	1.000	.125	.2357	851.1	1.316	.77202	9.07398	.61939	852.7	1.320	.77399	9.09717	.61621
47	90	2.000	.250	.4715	823.7	1.264	.74450	8.75052	.66315	820.7	1.265	.74500	8.75646	.66235
48	90	3.000	.375	.7072	782.4	1.197	.70974	8.34193	.71735	780.8	1.195	.70877	8.33056	.71885
49	90	4.000	.500	.9430	688.2	1.033	.62428	7.33750	.84882	686.6	1.031	.62325	7.32544	.85040

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE III.- DATA[a] FOR 140° CONE; $M_\infty = 3.95$

(a) $\alpha = 0°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 5775.8 psf					Φ = 22.5°, p_t = 5775.8 psf					Φ = 45.0°, p_t = 5775.8 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	818.1	1.750	.97822	20.11538	.17766	815.9	1.747	.97671	20.08447	.18378	815.9	1.747	.97671	20.08447	.18378
2	0	.200	.025	.0471	814.9	1.743	.97440	20.03681	.19285	813.7	1.740	.97289	20.00586	.19854	815.3	1.744	.97480	20.04517	.19129
3	0	.400	.050	.0943	811.7	1.736	.97057	19.95823	.20700	810.5	1.733	.96907	19.92725	.21234	812.1	1.737	.97098	19.96656	.20555
4	0	.600	.075	.1414	806.9	1.725	.96484	19.84037	.22670	805.7	1.722	.96333	19.80934	.23163	807.3	1.726	.96525	19.84865	.22537
5	0	.800	.100	.1886	802.1	1.714	.95911	19.72250	.24495	802.5	1.715	.95951	19.73073	.24371	802.5	1.715	.95951	19.73073	.24371
6	0	1.000	.125	.2357	798.9	1.707	.95529	19.64393	.25646	797.7	1.704	.95378	19.61282	.26090	797.7	1.704	.95378	19.61282	.26090
7	0	1.200	.150	.2829	794.2	1.696	.94956	19.52607	.27293	792.9	1.693	.94804	19.49491	.27714	792.9	1.693	.94804	19.49491	.27714
8	0	1.400	.175	.3300	789.4	1.685	.94383	19.40820	.28858	788.1	1.683	.94231	19.37699	.29260	788.1	1.683	.94231	19.37699	.29260
9	0	1.600	.200	.3772	785.2	1.678	.94001	19.32963	.29862	783.3	1.672	.93657	19.25908	.30739	783.3	1.672	.93657	19.25908	.30739
10	0	1.800	.225	.4243	779.8	1.664	.93236	19.17247	.31789	776.9	1.657	.92893	19.10187	.32624	775.9	1.657	.92893	19.10187	.32624
11	0	2.000	.250	.4715	775.0	1.653	.92663	19.05461	.33174	772.1	1.647	.92319	18.98395	.33982	772.1	1.647	.92319	18.98395	.33982
12	0	2.200	.275	.5186	768.6	1.639	.91899	18.89746	.34951	767.3	1.636	.91746	18.86604	.35298	765.7	1.632	.91555	18.82674	.35728
13	0	2.400	.300	.5658	762.2	1.624	.91135	18.74031	.36660	760.9	1.621	.90982	18.70882	.36994	757.7	1.614	.90599	18.63021	.37821
14	0	2.600	.325	.6129	752.6	1.603	.89988	18.50458	.39115	752.9	1.603	.90026	18.51230	.39036	749.7	1.596	.89644	18.43369	.39831
15	0	2.800	.350	.6601	744.6	1.585	.89033	18.30814	.41077	743.3	1.582	.88879	18.27648	.41387	740.1	1.575	.88497	18.19787	.42150
16	0	3.000	.375	.7072	735.0	1.563	.87887	18.07241	.43348	733.7	1.560	.87732	18.04065	.43648	730.5	1.553	.87350	17.96204	.44384
17	0	3.200	.400	.7544	722.2	1.534	.86358	17.75811	.46258	720.9	1.531	.86203	17.72622	.46546	716.2	1.521	.85630	17.60830	.47604
18	0	3.400	.425	.8015	706.3	1.498	.84448	17.36523	.49740	705.0	1.495	.84292	17.33317	.50018	701.8	1.488	.83909	17.25457	.50696
19	0	3.600	.450	.8487	688.7	1.459	.82346	16.93307	.53416	687.4	1.456	.82189	16.90083	.53685	684.2	1.449	.81807	16.82222	.54338
20	0	3.800	.475	.8958	661.5	1.398	.79098	16.26517	.58860	661.8	1.398	.79131	16.27196	.58806	658.6	1.391	.78749	16.19335	.59432
21	0	4.000	.500	.9430	620.0	1.304	.74130	15.24369	.66817	620.2	1.305	.74161	15.25005	.66769	617.0	1.298	.73779	15.17144	.67368
22	180	.200	.025	.0471	822.7	1.760	.98367	20.22758	.15353	820.5	1.756	.98109	20.17444	.16538	820.7	1.756	.98136	20.17996	.16418
23	180	.400	.050	.0943	817.9	1.750	.97795	20.10998	.17874	815.7	1.745	.97537	20.05692	.18907	815.0	1.745	.97563	20.06218	.18807
24	180	.600	.075	.1414	813.1	1.739	.97223	19.99238	.20097	812.6	1.738	.97156	19.97857	.20343	811.2	1.735	.96990	19.94440	.20940
25	180	.800	.100	.1886	809.9	1.732	.96842	19.91398	.21459	807.8	1.727	.96585	19.86105	.22336	806.4	1.724	.96417	19.82662	.22889
26	180	1.000	.125	.2357	805.1	1.721	.96270	19.79638	.23366	803.0	1.716	.96013	19.74353	.24178	801.6	1.713	.95845	19.70883	.24698
27	180	1.200	.150	.2829	798.8	1.707	.95508	19.63957	.25709	796.6	1.702	.95251	19.58684	.26455	795.2	1.699	.95081	19.55179	.26941
28	180	1.400	.175	.3300	794.0	1.696	.94936	19.52197	.27349	791.8	1.691	.94680	19.46931	.28056	790.4	1.688	.94508	19.43401	.28521
30	180	1.800	.225	.4243	781.2	1.667	.93411	19.20837	.31358	780.7	1.666	.93346	19.19510	.31518	779.2	1.663	.93172	19.15919	.31948
31	180	2.000	.250	.4715	776.4	1.656	.92839	19.09076	.32754	774.3	1.652	.92584	19.03840	.33361	772.8	1.648	.92408	19.00214	.33775
32	180	2.200	.275	.5186	770.1	1.642	.92076	18.93396	.34545	767.9	1.637	.91822	18.88171	.35125	766.5	1.634	.91644	18.84510	.35527
33	180	2.400	.300	.5658	763.7	1.628	.91314	18.77716	.36264	760.0	1.619	.90870	18.68584	.37238	760.1	1.620	.90881	18.68806	.37214
34	180	2.600	.325	.6129	754.1	1.606	.90170	18.54195	.38733	752.0	1.601	.89917	18.48997	.39263	752.1	1.602	.89926	18.49176	.39245
35	180	2.800	.350	.6601	744.6	1.585	.89026	18.30675	.41091	742.5	1.580	.88774	18.25493	.41597	740.9	1.576	.88589	18.21693	.41966
36	180	3.000	.375	.7072	733.4	1.559	.87692	18.03234	.43726	732.9	1.558	.87631	18.01989	.43843	731.3	1.555	.87444	17.98137	.44204
37	180	3.200	.400	.7544	722.2	1.534	.86357	17.75794	.46259	720.1	1.530	.86107	17.70650	.46724	720.1	1.530	.86107	17.70654	.46724
38	180	3.400	.425	.8015	707.9	1.502	.84642	17.40513	.49393	705.8	1.497	.84393	17.35394	.49838	704.2	1.494	.84198	17.31394	.50184
39	180	3.600	.450	.8487	648.8	1.459	.82354	16.93472	.53403	686.7	1.454	.82107	16.88385	.53826	685.0	1.451	.81907	16.84281	.54167
40	180	3.800	.475	.8958	664.8	1.405	.79495	16.34671	.58208	662.8	1.401	.79249	16.29625	.58612	661.1	1.397	.79043	16.25390	.58950
41	180	4.000	.500	.9430	621.8	1.308	.74347	15.28829	.66476	621.4	1.307	.74296	15.27773	.66557	619.6	1.303	.74079	15.23312	.66898
42	270	1.000	.125	.2357	805.1	1.721	.96270	19.79638	.23366	804.6	1.720	.96204	19.78270	.23578	804.8	1.720	.96226	19.78736	.23506
43	270	2.000	.250	.4715	776.4	1.656	.92839	19.09076	.32754	775.9	1.655	.92775	19.07758	.32908	777.6	1.659	.92981	19.11993	.32413
44	270	3.000	.375	.7072	733.4	1.559	.87692	18.03234	.43726	732.9	1.558	.87631	18.01989	.43843	734.5	1.562	.87826	18.05989	.43466
45	270	4.000	.500	.9430	625.0	1.315	.74729	15.36669	.65876	626.1	1.318	.74868	15.39525	.65657	625.9	1.318	.74843	15.39017	.65696
46	90	1.000	.125	.2357	795.7	1.700	.95147	19.56535	.26754	794.5	1.697	.94995	19.53421	.27182	796.1	1.701	.95187	19.57352	.26641
47	90	2.000	.250	.4715	768.6	1.639	.91899	18.89746	.34951	767.3	1.636	.91746	18.86604	.35298	768.9	1.639	.91937	18.90534	.34863
48	90	3.000	.375	.7072	727.0	1.545	.86931	17.87598	.45181	725.7	1.542	.86776	17.84413	.45473	728.9	1.549	.87159	17.92274	.44749
49	90	4.000	.500	.9430	616.8	1.297	.73748	15.16511	.67417	617.0	1.298	.73779	15.17144	.67368	620.2	1.305	.74161	15.25005	.66769

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.
Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE III.- DATA[a] FOR 140° CONE; M_∞ = 3.95 - Continued

(a) α = 0° - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 5775.8 psf					Φ = 90.0°, p_t = 5775.8 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.030	.000	.0000	815.1	1.744	.97467	20.04238	.19181	815.2	1.744	.97473	20.04377	.19155
2	0	.200	.025	.0471	815.1	1.744	.97457	20.04238	.19181	813.6	1.740	.97282	20.00447	.19879
3	0	.400	.050	.0943	810.4	1.733	.96893	19.92448	.21281	810.4	1.733	.96900	19.92587	.21258
4	0	.600	.075	.1414	805.6	1.722	.96320	19.80659	.23206	805.6	1.722	.96327	19.80796	.23184
5	0	.800	.100	.1886	800.8	1.711	.95747	19.68869	.24996	800.8	1.711	.95753	19.69006	.24976
6	0	1.000	.125	.2357	797.6	1.704	.95364	19.61009	.26128	797.6	1.704	.95371	19.61146	.26109
7	0	1.200	.150	.2829	791.2	1.690	.94600	19.45290	.28273	791.2	1.690	.94607	19.45425	.28255
8	0	1.400	.175	.3300	786.4	1.679	.94027	19.33500	.29794	786.4	1.679	.94033	19.33635	.29777
9	0	1.600	.200	.3772	781.6	1.668	.93453	19.21711	.31252	780.0	1.664	.93269	19.17914	.31709
10	0	1.800	.225	.4243	775.2	1.654	.92689	19.05991	.33113	773.6	1.650	.92504	19.02193	.33550
11	0	2.000	.250	.4715	768.8	1.639	.91924	18.90272	.34893	768.9	1.639	.91931	18.90403	.34878
12	0	2.200	.275	.5186	762.4	1.625	.91160	18.74552	.36604	760.9	1.621	.90975	18.70752	.37008
13	0	2.400	.300	.5658	754.4	1.607	.90204	18.54903	.38661	752.9	1.603	.90020	18.51101	.39049
14	0	2.600	.325	.6129	746.4	1.589	.89249	18.35253	.40639	744.9	1.595	.89064	18.31451	.41014
15	0	2.800	.350	.6601	736.8	1.567	.88102	18.11674	.42927	735.3	1.564	.87917	18.07870	.43289
16	0	3.000	.375	.7072	727.2	1.546	.86956	17.88095	.45135	724.1	1.539	.86579	17.80359	.45844
17	0	3.200	.400	.7544	712.9	1.513	.85236	17.52726	.48322	709.7	1.506	.84859	17.44987	.49003
18	0	3.400	.425	.8015	698.5	1.481	.83516	17.17357	.51388	696.9	1.477	.83330	17.13546	.51713
19	0	3.600	.450	.8487	680.9	1.441	.81413	16.74128	.55005	677.7	1.434	.81037	16.66384	.55641
20	0	3.800	.475	.8958	653.7	1.380	.78164	16.07320	.60384	650.6	1.373	.77788	15.99572	.60994
21	0	4.000	.500	.9430	613.8	1.290	.73387	15.09073	.67983	612.2	1.287	.73201	15.05248	.68274
22	180	.200	.025	.0471	818.1	1.750	.97823	20.11558	.17762	820.7	1.756	.98129	20.17856	.16449
23	180	.400	.050	.0943	813.3	1.739	.97251	19.99794	.19997	814.3	1.742	.97365	20.02153	.19568
24	180	.600	.075	.1414	810.2	1.732	.96869	19.91952	.21366	811.1	1.734	.96983	19.94301	.20964
25	180	.800	.100	.1886	803.8	1.718	.96106	19.76267	.23887	804.7	1.720	.96220	19.78598	.23528
26	180	1.000	.125	.2357	799.0	1.707	.95534	19.64504	.25630	799.9	1.709	.95647	19.66821	.25295
27	180	1.200	.150	.2829	792.6	1.693	.94772	19.48819	.27804	795.1	1.698	.95074	19.55043	.26960
28	180	1.400	.175	.3300	789.4	1.686	.94390	19.40977	.28837	790.4	1.688	.94502	19.43266	.28539
30	180	1.800	.225	.4243	776.7	1.657	.92865	19.09607	.32692	779.2	1.663	.93165	19.15785	.31964
31	180	2.000	.250	.4715	771.9	1.646	.92293	18.97844	.34044	772.8	1.648	.92402	19.00082	.33790
32	180	2.200	.275	.5186	765.5	1.632	.91530	18.82159	.35784	766.4	1.634	.91638	18.84379	.35542
33	180	2.400	.300	.5658	757.5	1.614	.90576	18.62553	.37870	758.4	1.616	.90683	18.64750	.37640
34	180	2.600	.325	.6129	749.6	1.596	.89623	18.42947	.39873	750.4	1.598	.89729	18.45121	.39655
35	180	2.800	.350	.6601	740.0	1.574	.88479	18.19420	.42185	742.5	1.580	.88774	18.25492	.41597
36	180	3.000	.375	.7072	730.4	1.553	.87335	17.95893	.44413	732.9	1.558	.87629	18.01937	.43848
37	180	3.200	.400	.7544	717.7	1.524	.85809	17.64524	.47274	720.1	1.530	.86101	17.70531	.46735
38	180	3.400	.425	.8015	703.3	1.492	.84093	17.29234	.50371	705.7	1.497	.84383	17.35199	.49855
39	180	3.600	.450	.8487	685.8	1.452	.81996	16.86101	.54016	686.6	1.454	.82092	16.88090	.53851
40	180	3.800	.475	.8958	661.8	1.398	.79135	16.27283	.58799	662.6	1.400	.79229	16.29203	.58646
41	180	4.000	.500	.9430	620.4	1.305	.74177	15.25333	.66743	621.1	1.307	.74265	15.27132	.66606
42	270	1.000	.125	.2357	803.8	1.718	.96106	19.76267	.23887	803.1	1.716	.96029	19.74672	.24130
43	270	2.000	.250	.4715	776.7	1.657	.92865	19.09607	.32692	776.0	1.655	.92783	19.07934	.32887
44	270	3.000	.375	.7072	735.2	1.564	.87907	18.07657	.43309	734.5	1.562	.87820	18.05863	.43478
45	270	4.000	.500	.9430	626.8	1.319	.74940	15.41018	.65542	625.9	1.317	.74838	15.38910	.65704
46	90	1.000	.125	.2357	796.0	1.700	.95173	19.57080	.26678	796.0	1.700	.95180	19.57216	.26660
47	90	2.000	.250	.4715	772.0	1.646	.92307	18.98131	.34012	772.0	1.646	.92313	18.98263	.33997
48	90	3.000	.375	.7072	730.4	1.553	.87338	17.95954	.44407	732.1	1.557	.87535	18.00009	.44029
49	90	4.000	.500	.9430	621.8	1.308	.74342	15.28723	.66484	621.8	1.308	.74347	15.28829	.66476

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE III.- DATA[a] FOR 140° CONE; $M_\infty = 3.95$ - Continued

(b) $\alpha = 5°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 5775.8 psf					Φ = 22.5°, p_t = 5766.3 psf					Φ = 45.0°, p_t = 5775.8 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.300	.300	.0000	815.3	1.744	.97480	20.04517	.19129	811.8	1.739	.97231	19.99386	.20070	811.9	1.736	.97078	19.96240	.20628
2	0	.230	.025	.0471	799.3	1.708	.95569	19.65212	.25528	797.5	1.707	.95508	19.63964	.25708	800.7	1.711	.95740	19.68732	.25016
3	0	.430	.050	.0943	794.5	1.697	.94995	19.53421	.27182	792.7	1.696	.94934	19.52156	.27354	795.9	1.700	.95167	19.56943	.26697
4	0	.530	.075	.1414	789.7	1.686	.94422	19.41630	.28752	787.9	1.685	.94360	19.40349	.28919	791.1	1.689	.94593	19.45155	.28291
5	0	.800	.100	.1886	783.3	1.672	.93657	19.25908	.30739	781.5	1.671	.93594	19.24606	.30899	786.3	1.679	.94020	19.33366	.29811
6	0	1.030	.125	.2357	776.9	1.657	.92893	19.10187	.32624	776.7	1.660	.93020	19.12798	.32318	779.9	1.664	.93256	19.17647	.31741
7	0	1.200	.150	.2829	770.5	1.643	.92128	18.94465	.34425	770.3	1.645	.92254	18.97055	.34134	773.5	1.650	.92491	19.01929	.33580
8	0	1.430	.175	.3300	765.7	1.632	.91555	18.82674	.35728	765.5	1.635	.91680	18.85248	.35446	770.3	1.643	.92109	18.94070	.34469
9	0	1.630	.200	.3772	759.3	1.618	.90790	18.66952	.37409	759.1	1.620	.90915	18.69505	.37140	762.4	1.625	.91154	18.74422	.36618
10	0	1.800	.225	.4243	752.9	1.603	.90026	18.51230	.39036	752.7	1.606	.90149	18.53761	.38778	757.6	1.614	.90580	18.62633	.37861
11	0	2.000	.250	.4715	746.5	1.589	.89261	18.35508	.40614	746.3	1.591	.89383	18.38018	.40365	751.2	1.599	.89816	18.46915	.39474
12	0	2.230	.275	.5186	738.5	1.571	.88306	18.15856	.42528	738.3	1.573	.88426	18.18339	.42289	744.8	1.585	.89052	18.31196	.41039
13	0	2.430	.300	.5658	732.1	1.557	.87541	18.00135	.44017	731.9	1.559	.87661	18.02596	.43786	736.8	1.567	.88096	18.11548	.42939
14	0	2.630	.325	.6129	722.5	1.535	.86394	17.76552	.46190	723.9	1.541	.86704	17.82917	.45610	728.8	1.549	.87141	17.91900	.44784
15	0	2.800	.350	.6601	713.0	1.513	.85247	17.52970	.48301	714.4	1.519	.85555	17.59302	.47740	719.2	1.528	.85994	17.68322	.46933
16	0	3.000	.375	.7072	703.4	1.492	.84101	17.29387	.50358	704.8	1.498	.84407	17.35687	.49813	708.0	1.502	.84656	17.40815	.49367
17	0	3.200	.400	.7544	689.0	1.459	.82380	16.94013	.53357	692.0	1.469	.82876	17.04201	.52503	695.2	1.474	.83128	17.09378	.52066
18	0	3.400	.425	.8015	676.2	1.431	.80851	16.62570	.55952	677.6	1.436	.81153	16.68779	.55445	682.4	1.445	.81599	16.77961	.54691
19	0	3.630	.450	.8487	658.6	1.391	.78749	16.19335	.59432	660.0	1.397	.79048	16.25485	.58942	664.9	1.405	.79497	16.34716	.58204
20	0	3.800	.475	.8958	633.0	1.334	.75691	15.56448	.64356	634.5	1.339	.75985	15.62512	.63885	639.3	1.348	.76439	15.71842	.63162
21	0	4.000	.500	.9430	596.3	1.251	.71294	14.66048	.71239	595.1	1.253	.71392	14.68053	.71088	600.9	1.261	.71853	14.77532	.70373
22	180	.230	.025	.0471	832.6	1.783	.99553	20.47133	.08006	829.2	1.778	.99307	20.42078	.09974	826.0	1.768	.98769	20.31022	.13313
23	180	.400	.050	.0943	832.6	1.783	.99553	20.47133	.08006	827.6	1.775	.99116	20.38150	.11271	824.4	1.764	.98578	20.27101	.14316
24	180	.500	.075	.1414	829.4	1.776	.99171	20.39289	.10910	826.0	1.771	.98925	20.34223	.12436	821.3	1.757	.98197	20.19260	.16142
25	180	.800	.100	.1886	827.8	1.772	.98980	20.35367	.12108	821.2	1.760	.98352	20.22442	.15426	818.1	1.750	.97816	20.11418	.17790
26	180	1.300	.125	.2357	823.0	1.761	.98408	20.23602	.15157	819.6	1.757	.98161	20.18515	.16306	813.3	1.739	.97244	19.99655	.20022
27	180	1.230	.150	.2829	819.8	1.754	.98027	20.15759	.16897	813.2	1.742	.97397	20.02807	.19447	808.5	1.729	.96672	19.87892	.22043
28	180	1.400	.175	.3300	815.1	1.743	.97455	20.03994	.19227	810.0	1.735	.97015	19.94953	.20852	803.7	1.718	.96100	19.76130	.23908
30	180	1.800	.225	.4243	805.5	1.722	.96310	19.80464	.23237	800.5	1.713	.95869	19.71390	.24623	794.1	1.696	.94956	19.52604	.27293
31	180	2.000	.250	.4715	802.3	1.715	.95929	19.72620	.24439	795.7	1.703	.95296	19.59609	.26325	789.4	1.685	.94384	19.40842	.28855
32	180	2.230	.275	.5186	795.9	1.700	.95166	19.56933	.26699	789.3	1.688	.94532	19.43901	.28456	783.0	1.671	.93621	19.25158	.30831
33	180	2.430	.300	.5658	789.5	1.686	.94403	19.41246	.28802	782.9	1.674	.93769	19.28192	.30457	776.6	1.657	.92858	19.09475	.32708
34	180	2.600	.325	.6129	781.6	1.668	.93450	19.21638	.31261	776.6	1.660	.93005	19.12484	.32355	768.6	1.639	.91905	18.89870	.34937
35	180	2.830	.350	.6601	773.6	1.650	.92496	19.02029	.33568	768.6	1.642	.92050	18.92849	.34606	760.7	1.621	.90952	18.70266	.37060
36	180	3.000	.375	.7072	765.6	1.632	.91543	18.82421	.35755	759.0	1.620	.90904	18.69286	.37163	751.1	1.599	.89807	18.46740	.39491
37	180	3.200	.400	.7544	752.8	1.603	.90017	18.51047	.39055	747.9	1.595	.89567	18.41797	.39988	739.9	1.574	.88473	18.19294	.42197
38	180	3.400	.425	.8015	740.1	1.575	.88491	18.19673	.42161	733.5	1.562	.87848	18.06453	.43423	725.6	1.542	.86757	17.84006	.45511
39	180	3.600	.450	.8487	720.9	1.531	.85203	17.72613	.46547	715.0	1.523	.85748	17.63255	.47387	706.4	1.499	.84469	17.36955	.49703
40	180	3.800	.475	.8958	697.0	1.478	.83342	17.13787	.51692	690.4	1.465	.82692	17.00422	.52821	682.5	1.445	.81609	16.78142	.54675
41	180	4.000	.500	.9430	654.0	1.381	.78193	16.07901	.60338	647.4	1.368	.77536	15.94391	.61401	639.5	1.348	.76460	15.72278	.63128
42	270	1.000	.125	.2357	803.9	1.718	.96120	19.76542	.23845	813.0	1.735	.97015	19.94953	.20852	816.5	1.747	.97625	20.07497	.18562
43	270	2.000	.250	.4715	775.2	1.654	.92687	19.05951	.33117	782.9	1.674	.93769	19.28192	.30457	792.6	1.693	.94765	19.48683	.27822
44	270	3.000	.375	.7072	733.7	1.560	.87728	18.03987	.43655	743.1	1.584	.88994	18.30016	.41155	754.3	1.607	.90189	18.54582	.38693
45	270	4.000	.500	.9430	626.8	1.320	.74951	15.41232	.65526	633.0	1.336	.75817	15.59048	.64153	645.8	1.362	.77223	15.87961	.61905
46	90	1.000	.125	.2357	792.9	1.693	.94804	19.49491	.27714	743.1	1.674	.93786	19.28542	.30414	779.9	1.664	.93256	19.17647	.31741
47	90	2.000	.250	.4715	765.7	1.632	.91555	18.82674	.35728	755.9	1.613	.90532	18.61633	.37966	749.6	1.596	.89625	18.42985	.39869
48	90	3.000	.375	.7072	722.5	1.535	.86394	17.76552	.46190	712.8	1.516	.85364	17.55366	.48089	708.0	1.502	.84656	17.40815	.49367
49	90	4.000	.500	.9430	613.8	1.290	.73397	15.09283	.67967	607.3	1.278	.72732	14.95604	.69006	602.5	1.265	.72044	14.81461	.70076

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE III.- DATA[a] FOR 140° CONE; $M_\infty = 3.95$ - Continued

(b) $\alpha = 5°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 5775.8 psf					Φ = 90.0°, p_t = 5775.8 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	811.7	1.736	.97057	19.95823	.20700	810.4	1.733	.96893	19.92448	.21281
2	0	.200	.025	.0471	802.1	1.714	.95911	19.72250	.24495	807.2	1.726	.96511	19.84589	.22581
3	0	.400	.050	.0943	798.9	1.707	.95529	19.64393	.25646	805.6	1.722	.96320	19.80659	.23206
4	0	.600	.075	.1414	794.2	1.696	.94956	19.52607	.27293	800.8	1.711	.95747	19.68869	.24996
5	0	.800	.100	.1886	791.0	1.689	.94574	19.44749	.28344	799.2	1.708	.95556	19.64939	.25568
6	0	1.000	.125	.2357	786.2	1.678	.94001	19.32963	.29862	794.4	1.697	.94982	19.53150	.27219
7	0	1.200	.150	.2829	778.2	1.660	.93045	19.13319	.32256	788.0	1.682	.94218	19.37430	.29294
8	0	1.400	.175	.3300	773.4	1.649	.92472	19.01532	.33625	783.2	1.672	.93644	19.25640	.30772
9	0	1.600	.200	.3772	768.6	1.639	.91899	18.89746	.34951	778.4	1.661	.93071	19.13851	.32193
10	0	1.800	.225	.4243	763.8	1.628	.91326	18.77960	.36238	772.0	1.646	.92307	18.98131	.34012
11	0	2.000	.250	.4715	757.4	1.614	.90561	18.62244	.37902	765.6	1.632	.91542	18.82412	.35756
12	0	2.200	.275	.5186	749.4	1.596	.89606	18.42601	.39908	757.6	1.614	.90587	18.62762	.37848
13	0	2.400	.300	.5658	743.0	1.581	.88842	18.26885	.41461	751.2	1.600	.89822	18.47043	.39461
14	0	2.600	.325	.6129	733.4	1.560	.87696	18.03313	.43719	743.2	1.582	.88867	18.27394	.41412
15	0	2.800	.350	.6601	725.4	1.542	.86740	17.83669	.45541	733.6	1.560	.87720	18.03814	.43671
16	0	3.000	.375	.7072	714.3	1.516	.85403	17.56167	.48018	724.0	1.538	.86573	17.80235	.45855
17	0	3.200	.400	.7544	701.5	1.488	.83874	17.24737	.50757	709.7	1.506	.84853	17.44866	.49013
18	0	3.400	.425	.8015	687.1	1.455	.82155	16.89378	.53744	696.9	1.477	.83324	17.13427	.51723
19	0	3.600	.450	.8487	669.5	1.416	.80053	16.46161	.57284	677.7	1.434	.81031	16.66269	.55650
20	0	3.800	.475	.8958	643.9	1.358	.75996	15.83301	.62269	652.1	1.377	.77973	16.03390	.60694
21	0	4.000	.500	.9430	605.6	1.272	.72411	14.89010	.69505	612.2	1.287	.73196	15.05143	.68282
22	180	.200	.025	.0471	819.5	1.753	.97986	20.14918	.17073	814.9	1.743	.97441	20.03715	.19279
23	180	.400	.050	.0943	816.3	1.746	.97605	20.07078	.18643	810.2	1.732	.96869	19.91952	.21366
24	180	.600	.075	.1414	813.1	1.739	.97223	19.99238	.20097	805.4	1.722	.96297	19.80188	.23280
25	180	.800	.100	.1886	808.3	1.728	.96652	19.87478	.22111	802.2	1.714	.95916	19.72346	.24480
26	180	1.000	.125	.2357	805.1	1.721	.96270	19.79638	.23366	797.4	1.704	.95344	19.60582	.26198
27	180	1.200	.150	.2829	800.4	1.710	.95698	19.67877	.25141	791.0	1.689	.94581	19.44898	.28325
28	180	1.400	.175	.3300	795.6	1.699	.95127	19.56117	.26812	786.2	1.678	.94009	19.33134	.29840
30	180	1.800	.225	.4243	784.4	1.674	.93792	19.28677	.30397	773.5	1.650	.92483	19.01765	.33599
31	180	2.000	.250	.4715	778.0	1.660	.93030	19.12996	.32294	768.7	1.639	.91911	18.90001	.34923
32	180	2.200	.275	.5186	771.7	1.646	.92267	18.97316	.34104	762.3	1.625	.91149	18.74317	.36629
33	180	2.400	.300	.5658	765.3	1.631	.91504	18.81636	.35841	755.9	1.610	.90386	18.58632	.38277
34	180	2.600	.325	.6129	757.3	1.613	.90551	18.62035	.37924	743.0	1.592	.89432	18.39026	.40265
35	180	2.800	.350	.6601	749.3	1.595	.89598	18.42435	.39924	738.4	1.571	.88288	18.15499	.42562
36	180	3.000	.375	.7072	738.2	1.570	.88264	18.14994	.42610	727.2	1.546	.86953	17.88051	.45139
37	180	3.200	.400	.7544	725.4	1.542	.86739	17.83634	.45545	716.1	1.520	.85619	17.60603	.47624
38	180	3.400	.425	.8015	712.7	1.513	.85214	17.52273	.48362	701.7	1.488	.83902	17.25313	.50708
39	180	3.600	.450	.8487	695.1	1.473	.83117	17.09152	.52085	684.2	1.449	.81805	16.82180	.54341
40	180	3.800	.475	.8958	669.6	1.416	.80066	16.46431	.57262	660.2	1.395	.78945	16.23362	.59112
41	180	4.000	.500	.9430	628.2	1.323	.75110	15.44509	.65274	618.8	1.301	.73987	15.21412	.67043
42	270	1.000	.125	.2357	819.5	1.753	.97986	20.14918	.17073	819.7	1.754	.98013	20.15479	.16956
43	270	2.000	.250	.4715	797.2	1.703	.95317	19.60037	.26265	797.4	1.704	.95344	19.60582	.26188
44	270	3.000	.375	.7072	760.5	1.621	.90933	18.69876	.37101	762.3	1.625	.91149	18.74317	.36629
45	270	4.000	.500	.9430	653.7	1.380	.78160	16.07231	.60391	653.9	1.380	.78182	16.07678	.60355
46	90	1.000	.125	.2357	775.6	1.657	.92854	19.09390	.32718	775.2	1.654	.92689	19.05991	.33113
47	90	2.000	.250	.4715	744.6	1.585	.89033	18.30814	.41077	744.8	1.585	.89058	18.31323	.41027
48	90	3.000	.375	.7072	703.1	1.491	.84065	17.28666	.50420	701.7	1.488	.83898	17.25217	.50716
49	90	4.000	.500	.9430	597.6	1.254	.71456	14.69366	.70989	597.8	1.254	.71476	14.69775	.70958

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE III.- DATA[a] FOR 140° CONE; $M_\infty = 3.95$ - Continued

(c) $\alpha = 10°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 5785.3 psf					Φ = 22.5°, p_t = 5775.8 psf					Φ = 45.0°, p_t = 5775.8 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	781.4	1.665	.93274	19.18025	.31696	779.8	1.664	.93243	19.17381	.31773	778.5	1.661	.93384	19.14117	.32162
2	0	.200	.025	.0471	754.2	1.604	.90031	18.51345	.39024	754.3	1.606	.90186	18.54516	.38700	757.7	1.614	.90599	18.63021	.37821
3	0	.400	.050	.0943	752.6	1.600	.89861	18.47623	.39422	752.7	1.603	.89995	18.50587	.39101	756.1	1.611	.90408	18.59091	.38229
4	0	.630	.075	.1414	751.0	1.596	.89650	18.43500	.39818	749.5	1.596	.89612	18.42729	.39895	752.9	1.603	.90026	18.51230	.39036
5	0	.800	.100	.1886	744.6	1.582	.88887	18.27811	.41371	744.7	1.585	.89039	18.30941	.41064	749.7	1.596	.89644	18.43369	.39831
6	0	1.000	.125	.2357	738.2	1.568	.88124	18.12122	.42885	738.3	1.570	.88275	18.15225	.42588	743.3	1.582	.88879	18.27648	.41387
7	0	1.200	.150	.2829	731.8	1.553	.87361	17.96432	.44363	731.9	1.556	.87511	17.99509	.44075	736.9	1.567	.88114	18.11926	.42903
8	0	1.400	.175	.3300	727.0	1.542	.86789	17.84665	.45450	727.1	1.545	.86937	17.87722	.45169	733.7	1.560	.87732	18.04065	.43648
9	0	1.630	.200	.3772	720.6	1.528	.86026	17.68976	.46875	720.7	1.531	.86173	17.72006	.46602	728.9	1.549	.87159	17.92274	.44749
10	0	1.800	.225	.4243	714.3	1.514	.85263	17.53286	.48273	714.3	1.517	.85409	17.56289	.48007	722.5	1.535	.86394	17.76552	.46190
11	0	2.000	.250	.4715	707.9	1.499	.84500	17.37597	.49647	707.9	1.502	.84645	17.40573	.49388	715.2	1.521	.85630	17.60830	.47604
12	0	2.200	.275	.5186	701.5	1.485	.83737	17.21908	.51000	703.1	1.491	.84071	17.28786	.50409	739.8	1.506	.84865	17.45109	.48992
13	0	2.430	.300	.5658	695.1	1.471	.82974	17.06218	.52333	695.1	1.473	.83116	17.09141	.52086	705.0	1.495	.84292	17.33317	.50018
14	0	2.600	.325	.6129	688.7	1.456	.82211	16.90529	.53648	688.7	1.459	.82352	16.93424	.53407	697.0	1.477	.83336	17.13665	.51702
15	0	2.800	.350	.6601	679.1	1.435	.81066	16.66995	.55591	680.7	1.441	.81396	16.73779	.55034	689.0	1.459	.82380	16.94013	.53357
16	0	3.000	.375	.7072	669.5	1.413	.79922	16.43461	.57502	669.6	1.416	.80059	16.46276	.57275	677.8	1.434	.81042	16.66500	.55631
17	0	3.200	.400	.7544	658.3	1.388	.78587	16.16005	.59696	660.0	1.394	.78912	16.22701	.59164	666.6	1.409	.79704	16.38987	.57862
18	0	3.400	.425	.8015	645.5	1.359	.77061	15.84626	.62166	647.2	1.365	.77384	15.91269	.61648	653.8	1.380	.78175	16.07544	.60366
19	0	3.600	.450	.8487	629.6	1.323	.75153	15.45402	.65205	631.2	1.329	.75473	15.51978	.64699	637.8	1.344	.76264	15.68240	.63441
20	0	3.800	.475	.8958	607.2	1.273	.72483	14.90490	.69393	608.8	1.279	.72798	14.96971	.68902	613.8	1.290	.73397	15.09283	.67967
21	0	4.000	.500	.9430	572.0	1.194	.68287	14.04198	.75878	573.7	1.200	.68595	14.10532	.75406	578.7	1.211	.69192	14.22814	.74485
22	180	.200	.025	.0471	816.3	1.743	.97445	20.03786	.19266	810.9	1.734	.96956	19.93747	.21059	803.9	1.718	.96120	19.76542	.23845
23	180	.400	.050	.0943	827.5	1.768	.98777	20.31181	.13271	822.1	1.759	.98292	20.21220	.15705	810.3	1.733	.96883	19.92229	.21319
24	180	.600	.075	.1414	832.2	1.779	.99348	20.42922	.09672	826.8	1.770	.98865	20.32994	.12780	813.5	1.740	.97264	20.00072	.19947
25	180	.800	.100	.1886	833.8	1.783	.99538	20.46836	.08134	826.8	1.770	.98865	20.32994	.12780	813.5	1.740	.97264	20.00072	.19947
26	180	1.000	.125	.2357	833.8	1.783	.99538	20.46836	.08134	826.8	1.770	.98865	20.32994	.12780	813.5	1.740	.97264	20.00072	.19947
27	180	1.230	.150	.2829	833.8	1.783	.99538	20.46836	.08134	825.2	1.766	.98674	20.29069	.13821	810.3	1.733	.96883	19.92229	.21319
28	180	1.400	.175	.3300	832.2	1.779	.99348	20.42922	.09672	823.7	1.763	.98483	20.25144	.14792	808.7	1.729	.96692	19.88307	.21975
30	180	1.800	.225	.4243	827.5	1.768	.98777	20.31181	.13271	817.3	1.748	.97720	20.09445	.18182	800.7	1.711	.95738	19.68698	.25021
31	180	2.000	.250	.4715	824.3	1.761	.98396	20.23354	.15215	815.7	1.745	.97529	20.05521	.19940	797.5	1.704	.95357	19.60855	.26150
32	180	2.200	.275	.5186	819.5	1.750	.97825	20.11613	.17751	810.9	1.734	.96956	19.93747	.21059	792.7	1.693	.94785	19.49090	.27768
33	180	2.430	.300	.5658	814.7	1.740	.97254	19.99872	.19983	804.5	1.720	.96193	19.78048	.23613	787.9	1.682	.94213	19.37325	.29308
34	180	2.600	.325	.6129	809.9	1.729	.96683	19.88131	.22004	799.7	1.709	.95620	19.66274	.25375	781.6	1.668	.93450	19.21638	.31261
35	180	2.830	.350	.6601	802.0	1.711	.95732	19.68563	.25041	791.7	1.691	.94666	19.46650	.28093	773.6	1.650	.92496	19.02029	.33568
36	180	3.000	.375	.7072	794.0	1.693	.94780	19.48995	.27780	783.7	1.673	.93712	19.27027	.30602	764.0	1.628	.91352	18.78499	.36180
37	180	3.200	.400	.7544	784.4	1.671	.93638	19.25513	.30788	772.6	1.648	.92376	18.99554	.33851	754.4	1.607	.90208	18.54969	.38654
38	180	3.400	.425	.8015	770.1	1.639	.91925	18.90290	.34891	759.8	1.619	.90849	18.68156	.37283	740.1	1.575	.88491	18.19673	.42161
39	180	3.600	.450	.8487	752.5	1.600	.89832	18.47240	.39441	742.2	1.579	.88750	18.24985	.41647	722.5	1.535	.86393	17.76535	.46192
40	180	3.800	.475	.8958	728.6	1.546	.86977	17.88535	.45094	718.3	1.526	.85887	17.66114	.47132	698.6	1.481	.83533	17.17709	.51358
41	180	4.000	.500	.9430	685.6	1.449	.81838	16.82867	.54284	675.2	1.428	.80733	16.60147	.56150	655.5	1.384	.78383	16.11823	.60028
42	270	1.000	.125	.2357	779.6	1.661	.93067	19.13772	.32203	796.5	1.702	.95239	19.58424	.26491	815.1	1.743	.97455	20.03994	.19227
43	270	2.000	.250	.4715	757.3	1.611	.90403	18.58981	.38241	779.0	1.662	.93139	19.15253	.32027	802.3	1.715	.95929	19.72620	.24439
44	270	3.000	.375	.7072	722.2	1.532	.86216	17.72881	.46523	743.8	1.583	.88940	18.28909	.41264	768.8	1.639	.91924	18.90264	.34893
45	270	4.000	.500	.9430	618.6	1.299	.73845	15.18494	.67266	638.5	1.346	.76344	15.69879	.63314	663.5	1.402	.79337	16.31431	.58468
46	90	1.000	.125	.2357	768.6	1.636	.91748	18.86646	.35293	752.7	1.603	.89995	18.50587	.39101	743.3	1.582	.88879	18.27648	.41387
47	90	2.000	.250	.4715	747.8	1.589	.89268	18.35656	.40600	728.7	1.549	.87128	17.91651	.44807	716.2	1.521	.85630	17.60830	.47604
48	90	3.000	.375	.7072	709.5	1.503	.84691	17.41519	.49306	690.3	1.463	.82543	16.97353	.53078	677.8	1.434	.81042	16.66500	.55631
49	90	4.000	.500	.9430	605.6	1.270	.72292	14.86567	.69690	589.7	1.236	.70505	14.49823	.72459	580.3	1.215	.69383	14.26744	.74191

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE III.- DATA[a] FOR 140° CONE; $M_\infty = 3.95$ - Continued

(c) $\alpha = 10°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 5775.8 psf					Φ = 90.0°, p_t = 5775.8 psf				
					p_t, psf	C_p	$p_t/p_{t,2}$	p_t/p_∞	M_t	p_t, psf	C_p	$p_t/p_{t,2}$	p_t/p_∞	M_t
1	0	.200	.000	.0000	776.7	1.657	.92874	19.09788	.32671	776.8	1.657	.92880	19.09921	.32656
2	0	.230	.025	.0471	764.0	1.628	.91345	18.78351	.36196	773.6	1.650	.92498	19.02061	.33565
3	0	.430	.050	.0943	762.4	1.625	.91154	18.74422	.36618	773.6	1.650	.92498	19.02061	.33565
4	0	.600	.075	.1414	760.8	1.621	.90963	18.70492	.37036	772.0	1.646	.92307	18.98131	.34012
5	0	.800	.100	.1886	756.0	1.610	.90389	18.58703	.38269	770.4	1.643	.92116	18.94201	.34454
6	0	1.000	.125	.2357	752.8	1.603	.90007	18.50844	.39075	768.8	1.639	.91924	18.90272	.34893
7	0	1.200	.150	.2829	748.0	1.592	.89434	18.39055	.40262	764.0	1.628	.91351	18.78482	.36182
8	0	1.400	.175	.3300	744.8	1.585	.89052	18.31196	.41039	760.8	1.621	.90969	18.70622	.37022
9	0	1.600	.200	.3772	738.4	1.571	.88287	18.15478	.42564	756.0	1.610	.90396	18.58833	.38256
10	0	1.800	.225	.4243	733.6	1.560	.87714	18.03689	.43683	752.8	1.603	.90013	18.50973	.39062
11	0	2.000	.250	.4715	728.8	1.549	.87141	17.91900	.44784	748.0	1.592	.89440	18.39183	.40249
12	0	2.200	.275	.5186	722.4	1.535	.86376	17.76182	.46224	741.6	1.578	.88676	18.23464	.41796
13	0	2.400	.300	.5658	716.0	1.520	.85612	17.60463	.47636	735.2	1.564	.87911	18.07744	.43300
14	0	2.600	.325	.6129	709.6	1.506	.84847	17.44745	.49024	728.8	1.549	.87147	17.92025	.44772
15	0	2.800	.350	.6601	701.6	1.488	.83892	17.25097	.50727	720.8	1.531	.86191	17.72375	.46568
16	0	3.000	.375	.7072	692.0	1.466	.82745	17.01519	.52729	709.7	1.506	.84853	17.44866	.49013
17	0	3.200	.400	.7544	680.8	1.441	.81408	16.74012	.55015	698.5	1.481	.83516	17.17357	.51388
18	0	3.400	.425	.8015	666.5	1.409	.79688	16.38645	.57889	685.7	1.452	.81987	16.85918	.54031
19	0	3.600	.450	.8487	648.9	1.369	.77586	15.95420	.61321	668.1	1.412	.79884	16.42689	.57564
20	0	3.800	.475	.8958	624.9	1.315	.74719	15.36476	.65891	642.5	1.355	.76827	15.79811	.62541
21	0	4.000	.500	.9430	588.1	1.232	.70324	14.46095	.72740	602.6	1.265	.72049	14.81564	.70068
22	180	.200	.025	.0471	794.1	1.696	.94956	19.52604	.27293	781.4	1.668	.93437	19.21371	.31293
23	180	.400	.050	.0943	794.1	1.696	.94956	19.52604	.27293	779.9	1.664	.93246	19.17450	.31765
24	180	.600	.075	.1414	795.7	1.700	.95146	19.56525	.26755	778.3	1.660	.93055	19.13528	.32231
25	180	.800	.100	.1886	794.1	1.696	.94956	19.52604	.27293	775.1	1.653	.92674	19.05686	.33148
26	180	1.000	.125	.2357	792.6	1.693	.94765	19.48683	.27822	773.5	1.650	.92483	19.01765	.33599
27	180	1.200	.150	.2829	789.4	1.685	.94384	19.40842	.28855	770.3	1.643	.92102	18.93923	.34486
28	180	1.400	.175	.3300	786.2	1.678	.94002	19.33000	.29857	765.5	1.632	.91530	18.82159	.35784
30	180	1.800	.225	.4243	778.2	1.660	.93049	19.13395	.32247	755.9	1.610	.90386	18.58632	.38277
31	180	2.000	.250	.4715	775.0	1.653	.92668	19.05554	.33163	752.7	1.603	.90004	18.50790	.39081
32	180	2.200	.275	.5186	768.6	1.639	.91905	18.89870	.34937	746.4	1.589	.89242	18.35105	.40654
33	180	2.400	.300	.5658	763.9	1.628	.91333	18.78107	.36227	740.0	1.574	.88479	18.19420	.42185
34	180	2.600	.325	.6129	755.9	1.610	.90380	18.58503	.38290	733.6	1.560	.87716	18.03736	.43679
35	180	2.800	.350	.6601	747.9	1.592	.89426	18.38898	.40278	726.0	1.538	.86572	17.80209	.45858
36	180	3.000	.375	.7072	739.9	1.574	.88473	18.19294	.42197	716.1	1.520	.85619	17.60603	.47624
37	180	3.200	.400	.7544	728.8	1.549	.87138	17.91848	.44788	703.3	1.492	.84093	17.29234	.50371
38	180	3.400	.425	.8015	716.0	1.520	.85613	17.60481	.47635	690.5	1.463	.82568	16.97864	.53035
39	180	3.600	.450	.8487	696.9	1.477	.83325	17.13430	.51722	673.0	1.424	.80470	16.54732	.56590
40	180	3.800	.475	.8958	674.5	1.427	.80655	16.58537	.56281	650.7	1.373	.77800	15.99835	.60974
41	180	4.000	.500	.9430	633.1	1.334	.75698	15.56594	.64343	610.8	1.283	.73033	15.01806	.68535
42	270	1.000	.125	.2357	827.6	1.772	.98960	20.34943	.12231	830.9	1.779	.99348	20.42927	.09671
43	270	2.000	.250	.4715	816.5	1.747	.97625	20.07497	.18562	821.3	1.757	.98204	20.19400	.16111
44	270	3.000	.375	.7072	786.6	1.675	.93812	19.29079	.30347	792.6	1.693	.94772	19.48819	.27804
45	270	4.000	.500	.9430	680.9	1.441	.81418	16.74221	.54998	685.8	1.452	.81996	16.86101	.54016
46	90	1.000	.125	.2357	738.4	1.571	.88287	18.15478	.42564	736.8	1.567	.88102	18.11674	.42927
47	90	2.000	.250	.4715	708.0	1.502	.84656	17.40815	.49367	706.5	1.499	.84471	17.37006	.49698
48	90	3.000	.375	.7072	669.7	1.416	.80070	16.46505	.57256	668.1	1.412	.79884	16.42689	.57564
49	90	4.000	.500	.9430	575.4	1.204	.68795	14.14658	.75096	573.8	1.200	.68609	14.10826	.75382

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE III.- DATA[a] FOR 140° CONE; $M_\infty = 3.95$ - Continued

(d) $\alpha = 15°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 5785.3 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.030	.000	.0000	725.7	1.539	.86628	17.81362	.45752
2	0	.230	.025	.0471	685.7	1.450	.81858	16.83269	.54251
3	0	.400	.050	.0943	695.3	1.471	.83003	17.06812	.52283
4	0	.630	.075	.1414	698.5	1.478	.83384	17.14659	.51618
5	0	.800	.100	.1886	695.3	1.471	.83003	17.06812	.52283
6	0	1.030	.125	.2357	690.5	1.460	.82430	16.95040	.53272
7	0	1.200	.150	.2829	685.7	1.450	.81858	16.83269	.54251
8	0	1.400	.175	.3300	680.9	1.439	.81285	16.71498	.55222
9	0	1.600	.200	.3772	676.1	1.428	.80713	16.59727	.56184
10	0	1.800	.225	.4243	671.3	1.417	.80141	16.47956	.57139
11	0	2.030	.250	.4715	666.6	1.407	.79568	16.36185	.58087
12	0	2.230	.275	.5186	661.8	1.396	.78996	15.24414	.59028
13	0	2.430	.300	.5658	657.0	1.385	.78423	16.12643	.59963
14	0	2.600	.325	.6129	650.6	1.371	.77660	15.96948	.61201
15	0	2.800	.350	.6601	644.2	1.356	.76897	15.81253	.62429
16	0	3.000	.375	.7072	636.2	1.338	.75943	15.61635	.63953
17	0	3.200	.400	.7544	626.6	1.317	.74798	15.38092	.65767
18	0	3.400	.425	.8015	615.4	1.292	.73462	15.10626	.67865
19	0	3.600	.450	.8487	602.6	1.263	.71936	14.79237	.70244
20	0	3.800	.475	.8958	583.4	1.220	.69646	14.32152	.73785
21	0	4.000	.500	.9430	553.1	1.151	.66021	13.57602	.79358
22	180	.200	.025	.0471	781.5	1.665	.93290	19.18352	.31657
23	180	.400	.050	.0943	811.8	1.733	.96907	19.92737	.21232
24	180	.600	.075	.1414	823.0	1.758	.98240	20.20142	.15947
25	180	.800	.100	.1886	829.3	1.772	.99002	20.35802	.11981
26	180	1.030	.125	.2357	830.9	1.776	.99192	20.39717	.10772
27	180	1.200	.150	.2829	832.5	1.780	.99382	20.43632	.09412
28	180	1.400	.175	.3300	834.1	1.783	.99573	20.47547	.07823
30	180	1.800	.225	.4243	832.5	1.780	.99382	20.43632	.09412
31	180	2.000	.250	.4715	832.5	1.780	.99382	20.43632	.09412
32	180	2.200	.275	.5186	830.9	1.776	.99192	20.39717	.10772
33	180	2.400	.300	.5658	829.3	1.772	.99002	20.35802	.11981
34	180	2.600	.325	.6129	824.6	1.762	.98430	20.24057	.15050
35	180	2.800	.350	.6601	821.4	1.755	.98050	20.16227	.16798
36	180	3.000	.375	.7072	815.0	1.740	.97288	20.00567	.19857
37	180	3.230	.400	.7544	808.6	1.726	.96527	19.84907	.22530
38	180	3.400	.425	.8015	797.5	1.701	.95194	19.57502	.26620
39	180	3.600	.450	.8487	781.5	1.665	.93290	19.18352	.31657
40	180	3.800	.475	.8958	760.8	1.618	.90815	18.67457	.37356
41	180	4.030	.500	.9430	719.3	1.525	.85865	17.65667	.47172
42	270	1.030	.125	.2357	738.4	1.568	.88150	18.12647	.42835
43	270	2.000	.250	.4715	727.3	1.543	.86817	17.85242	.45397
44	270	3.030	.375	.7072	700.2	1.482	.83580	17.18687	.51275
45	270	4.030	.500	.9430	604.5	1.267	.72157	14.83787	.69903
46	90	1.030	.125	.2357	725.7	1.539	.86628	17.81362	.45752
47	90	2.000	.250	.4715	714.5	1.514	.85292	17.53896	.48219
48	90	3.000	.375	.7072	684.1	1.446	.81667	16.79346	.54575
49	90	4.000	.500	.9430	588.2	1.231	.70218	14.43923	.72903

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE III.- DATA[a] FOR 140° CONE; $M_\infty = 3.95$ - Continued

(e) $\alpha = 20°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 5775.8 psf					Φ = 22.5°, p_t = 5775.8 psf					Φ = 45.0°, p_t = 5775.8 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	645.5	1.362	.77182	15.87119	.61971	645.8	1.362	.77220	15.87892	.61910	644.8	1.360	.77098	15.85393	.62106
2	0	.200	.025	.0471	594.4	1.247	.71069	14.61407	.71588	594.7	1.247	.71103	14.62118	.71535	601.6	1.263	.71933	14.79175	.70249
3	0	.400	.050	.0943	616.7	1.297	.73743	15.16406	.67425	615.4	1.294	.73588	15.13214	.67668	614.4	1.292	.73463	15.10647	.67863
4	0	.600	.075	.1414	631.1	1.329	.75463	15.51762	.64715	625.0	1.316	.74735	15.36796	.65866	622.4	1.310	.74420	15.30317	.66362
5	0	.800	.100	.1886	631.1	1.329	.75463	15.51762	.64715	625.0	1.316	.74735	15.36796	.65866	625.6	1.317	.74802	15.38185	.65759
6	0	1.000	.125	.2357	629.5	1.326	.75272	15.47834	.65018	623.4	1.312	.74544	15.32866	.66167	624.3	1.313	.74611	15.34251	.66061
7	0	1.200	.150	.2829	624.7	1.315	.74698	15.36048	.65923	621.8	1.308	.74353	15.28935	.66468	622.4	1.310	.74420	15.30317	.66362
8	0	1.400	.175	.3300	623.1	1.311	.74507	15.32120	.66224	620.2	1.305	.74161	15.25005	.66769	622.4	1.310	.74420	15.30317	.66362
9	0	1.600	.200	.3772	619.9	1.304	.74125	15.24263	.66825	617.0	1.298	.73779	15.17144	.67368	620.8	1.306	.74228	15.26383	.66663
10	0	1.800	.225	.4243	616.7	1.297	.73743	15.16406	.67425	613.8	1.290	.73397	15.09283	.67967	619.2	1.302	.74037	15.22449	.66964
11	0	2.000	.250	.4715	613.5	1.290	.73361	15.08549	.68023	610.6	1.283	.73015	15.01422	.68564	616.0	1.295	.73654	15.14581	.67564
12	0	2.200	.275	.5186	610.4	1.282	.72979	15.00692	.68620	607.5	1.276	.72632	14.93561	.69161	612.8	1.288	.73272	15.06713	.68162
13	0	2.400	.300	.5658	607.2	1.275	.72597	14.92835	.69216	634.3	1.269	.72250	14.85701	.69756	609.6	1.281	.72889	14.98845	.68760
14	0	2.600	.325	.6129	604.0	1.268	.72215	14.84978	.69810	601.1	1.262	.71868	14.77840	.70350	606.4	1.274	.72507	14.90977	.69356
15	0	2.800	.350	.6601	599.2	1.257	.71642	14.73192	.70700	596.3	1.251	.71294	14.66048	.71239	601.6	1.263	.71933	14.79175	.70249
16	0	3.000	.375	.7072	592.8	1.243	.70878	14.57478	.71884	589.9	1.236	.70530	14.50327	.72422	595.2	1.248	.71167	14.63439	.71435
17	0	3.200	.400	.7544	588.0	1.232	.70304	14.45693	.72770	585.1	1.226	.69956	14.38536	.73307	587.2	1.230	.70211	14.43769	.72914
18	0	3.400	.425	.8015	580.0	1.214	.69349	14.26050	.74243	577.1	1.208	.69031	14.18883	.74779	579.2	1.212	.69254	14.24099	.74389
19	0	3.600	.450	.8487	570.4	1.193	.68203	14.02479	.76006	565.9	1.192	.67663	13.91370	.76836	568.0	1.187	.67915	13.96562	.76649
20	0	3.800	.475	.8958	556.0	1.160	.66484	13.67122	.78647	551.5	1.150	.65942	13.55997	.79478	550.4	1.148	.65811	13.53288	.79680
21	0	4.000	.500	.9430	530.5	1.103	.63427	13.04266	.83343	524.3	1.089	.62693	12.89179	.84473	523.2	1.086	.62558	12.86410	.84680
22	180	.200	.025	.0471	727.8	1.547	.87017	17.89366	.45018	720.9	1.531	.86203	17.72613	.46547	701.7	1.488	.83897	17.25193	.50718
23	180	.400	.050	.0943	778.7	1.662	.93110	19.14660	.32097	765.6	1.632	.91543	18.82421	.35755	733.6	1.560	.87710	18.03610	.43691
24	180	.600	.075	.1414	801.0	1.712	.95776	19.69477	.24906	787.9	1.682	.94213	19.37325	.29308	752.7	1.603	.89998	18.50661	.39094
25	180	.800	.100	.1886	812.2	1.737	.97109	19.96885	.20514	797.5	1.704	.95357	19.60855	.26150	762.3	1.624	.91142	18.74186	.36643
26	180	1.000	.125	.2357	820.1	1.755	.98061	20.16662	.16748	805.5	1.722	.96310	19.80464	.23237	770.2	1.642	.92096	18.93791	.34500
27	180	1.200	.150	.2829	826.5	1.769	.98823	20.32124	.13018	811.9	1.736	.97073	19.96150	.20643	773.4	1.650	.92477	19.01633	.33614
28	180	1.400	.175	.3300	831.3	1.780	.99394	20.43871	.09323	816.6	1.747	.97645	20.07916	.18481	776.6	1.657	.92858	19.09475	.32708
29	180	1.600	.200	.3772	834.5	1.787	.99775	20.51702	.05675	819.8	1.754	.98027	20.15759	.16897	779.8	1.664	.93240	19.17316	.31781
30	180	1.800	.225	.4243	836.0	1.791	.99965	20.55617	.02229	819.8	1.754	.98027	20.15759	.16897	781.4	1.668	.93430	19.21237	.31309
31	180	2.000	.250	.4715	836.0	1.791	.99965	20.55617	.02229	819.8	1.754	.98027	20.15759	.16897	779.8	1.664	.93240	19.17316	.31781
32	180	2.200	.275	.5186	836.0	1.791	.99965	20.55617	.02229	819.8	1.754	.98027	20.15759	.16897	778.2	1.660	.93049	19.13395	.32247
33	180	2.400	.300	.5658	836.0	1.791	.99965	20.55617	.02229	818.2	1.750	.97836	20.11837	.17706	776.6	1.657	.92858	19.09475	.32708
34	180	2.600	.325	.6129	836.0	1.791	.99965	20.55617	.02229	815.1	1.743	.97455	20.03994	.19227	771.8	1.646	.92286	18.97712	.34059
35	180	2.800	.350	.6601	832.9	1.783	.99584	20.47786	.07716	810.3	1.733	.96883	19.92229	.21319	767.0	1.635	.91714	18.85949	.35370
36	180	3.000	.375	.7072	828.1	1.773	.99013	20.36040	.11911	803.9	1.718	.96120	19.76542	.23845	760.7	1.621	.90952	18.70266	.37060
37	180	3.200	.400	.7544	823.3	1.762	.98442	20.24293	.14995	795.9	1.700	.95166	19.56933	.26699	749.5	1.596	.89617	18.42819	.39886
38	180	3.400	.425	.8015	815.3	1.744	.97490	20.04716	.19092	783.2	1.671	.93640	19.25560	.30782	736.7	1.567	.88091	18.11452	.42948
39	180	3.600	.450	.8487	804.2	1.719	.96157	19.77308	.23727	764.0	1.628	.91352	18.78499	.36180	715.0	1.520	.85613	17.60481	.47635
40	180	3.800	.475	.8958	795.1	1.676	.93872	19.30322	.30193	724.1	1.539	.86584	17.80456	.45835	677.7	1.434	.81036	16.66379	.55641
41	180	4.000	.500	.9430	746.9	1.590	.89302	18.36351	.40531	724.1	1.539	.86584	17.80456	.45835	773.4	1.650	.92477	19.01633	.33614
42	270	1.000	.125	.2357	678.4	1.436	.81115	16.67986	.55510	732.1	1.557	.87538	18.00065	.44023	784.6	1.675	.93812	19.29079	.30347
43	270	2.000	.250	.4715	680.0	1.439	.81305	16.71902	.55188	717.8	1.524	.85821	17.64770	.47252	773.4	1.650	.92477	19.01633	.33614
44	270	3.000	.375	.7072	662.5	1.400	.79211	16.28832	.58675	628.4	1.323	.75141	15.45154	.65224	685.7	1.452	.81990	16.85984	.54026
45	270	4.000	.500	.9430	579.7	1.213	.69309	14.25228	.74304	636.2	1.341	.76073	15.64309	.63746	625.6	1.317	.74802	15.38185	.65759
46	90	1.000	.125	.2357	566.3	1.408	.79666	16.39190	.57926	631.4	1.330	.75499	15.52518	.64657	616.0	1.295	.73654	15.14581	.67564
47	90	2.000	.250	.4715	567.9	1.412	.79857	16.42118	.57610	610.6	1.283	.73015	15.01422	.68564	595.2	1.248	.71167	14.63439	.71435
48	90	3.000	.375	.7072	648.7	1.369	.77564	15.94976	.61355	610.6	1.283	.73015	15.01422	.68564	526.4	1.093	.62941	12.94278	.84091
49	90	4.000	.500	.9430	565.6	1.182	.67630	13.90693	.76887	535.5	1.114	.64031	13.16692	.82413					

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE III.- DATA[a] FOR 140° CONE; $M_\infty = 3.95$ - Concluded

(e) $\alpha = 20°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 5775.8 psf					Φ = 90.0°, p_t = 5775.8 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.030	.000	.0000	644.0	1.358	.77007	15.83521	.62252	643.9	1.358	.76996	15.83301	.62269
2	0	.230	.025	.0471	616.9	1.297	.73759	15.16722	.67401	639.2	1.347	.76423	15.71514	.63187
3	0	.430	.050	.0943	621.7	1.308	.74332	15.28510	.66501	645.5	1.362	.77187	15.87229	.61962
4	0	.600	.075	.1414	629.7	1.326	.75287	15.48157	.64993	656.7	1.387	.78525	16.14731	.59797
5	0	.830	.100	.1886	632.9	1.333	.75669	15.56016	.64387	663.1	1.401	.79289	16.30446	.58546
6	0	1.300	.125	.2357	634.5	1.337	.75861	15.59945	.64084	666.3	1.408	.79671	16.38304	.57917
7	0	1.230	.150	.2829	636.0	1.340	.76052	15.63874	.63780	669.5	1.416	.80053	16.46161	.57284
8	0	1.400	.175	.3300	636.0	1.340	.76052	15.63874	.63780	671.1	1.419	.80244	16.50090	.56966
9	0	1.600	.200	.3772	634.5	1.337	.75861	15.59945	.64084	671.1	1.419	.80244	16.50090	.56966
10	0	1.800	.225	.4243	634.5	1.337	.75861	15.59945	.64084	671.1	1.419	.80244	16.50090	.56966
11	0	2.030	.250	.4715	632.9	1.333	.75669	15.56016	.64387	669.5	1.416	.80053	16.46161	.57284
12	0	2.230	.275	.5186	629.7	1.326	.75287	15.48157	.64993	667.9	1.412	.79862	16.42232	.57601
13	0	2.400	.300	.5658	626.5	1.319	.74905	15.40298	.65597	664.7	1.405	.79480	16.34375	.58232
14	0	2.630	.325	.6129	623.3	1.312	.74523	15.32440	.66200	661.5	1.398	.79098	16.26517	.58860
15	0	2.800	.350	.6601	618.5	1.301	.73950	15.20652	.67101	656.7	1.387	.78525	16.14731	.59797
16	0	3.000	.375	.7072	612.1	1.286	.73185	15.04934	.68298	650.3	1.373	.77761	15.99016	.61038
17	0	3.200	.400	.7544	604.1	1.268	.72230	14.85288	.69787	643.9	1.358	.76996	15.83301	.62269
18	0	3.430	.425	.8015	594.5	1.247	.71083	14.61712	.71565	632.8	1.333	.75659	15.55799	.64404
19	0	3.600	.450	.8487	581.7	1.218	.69555	14.30277	.73926	620.0	1.304	.74130	15.24369	.66817
20	0	3.800	.475	.8958	564.1	1.178	.67453	13.87054	.77159	599.2	1.257	.71647	14.73295	.70693
21	0	4.000	.500	.9430	533.8	1.110	.63822	13.12397	.82735	564.1	1.178	.67443	13.85861	.77173
22	180	.230	.025	.0471	676.1	1.430	.80840	16.62343	.55971	648.0	1.367	.77483	15.93317	.61486
23	180	.400	.050	.0943	692.0	1.466	.82747	17.01549	.52726	651.2	1.374	.77865	16.01166	.60869
24	180	.600	.075	.1414	706.4	1.499	.84463	17.36835	.49713	662.4	1.400	.79201	16.28636	.58691
25	180	.800	.100	.1886	712.8	1.513	.85225	17.52517	.48341	667.2	1.410	.79774	16.40410	.57747
26	180	1.000	.125	.2357	719.1	1.527	.85988	17.68199	.46945	672.3	1.421	.80346	16.52183	.56797
27	180	1.230	.150	.2829	723.9	1.538	.86560	17.79961	.45880	675.2	1.428	.80728	16.60032	.56159
28	180	1.430	.175	.3300	725.5	1.542	.86751	17.83882	.45522	675.2	1.428	.80728	16.60032	.56159
30	180	1.800	.225	.4243	727.1	1.545	.86941	17.87803	.45162	675.2	1.428	.80728	16.60032	.56159
31	180	2.000	.250	.4715	727.1	1.545	.86941	17.87803	.45162	675.2	1.428	.80728	16.60032	.56159
32	180	2.200	.275	.5186	725.5	1.542	.86751	17.83882	.45522	672.0	1.421	.80346	16.52183	.56797
33	180	2.400	.300	.5658	723.9	1.538	.86560	17.79961	.45880	670.4	1.418	.80155	16.48259	.57114
34	180	2.630	.325	.6129	720.7	1.531	.86179	17.72120	.46591	665.6	1.407	.79583	16.36485	.58063
35	180	2.800	.350	.6601	715.0	1.520	.85607	17.60358	.47646	660.8	1.396	.79010	16.24712	.59004
36	180	3.000	.375	.7072	709.6	1.506	.84844	17.44676	.49030	654.4	1.382	.78247	16.09014	.60250
37	180	3.200	.400	.7544	703.2	1.492	.84081	17.28993	.50391	648.0	1.367	.77483	15.93317	.61486
38	180	3.430	.425	.8015	693.6	1.470	.82937	17.05470	.52396	635.9	1.342	.76148	15.65846	.63627
39	180	3.630	.450	.8487	677.7	1.434	.81031	16.66263	.55651	622.5	1.310	.74430	15.30526	.66346
40	180	3.800	.475	.8958	658.6	1.391	.78743	16.19216	.59441	634.9	1.270	.72331	14.87357	.69630
41	180	4.000	.500	.9430	620.3	1.305	.74167	15.25121	.66760	569.8	1.191	.68132	14.01020	.76115
42	270	1.000	.125	.2357	806.9	1.725	.96474	19.83834	.22702	819.8	1.752	.97904	20.13230	.17422
43	270	2.000	.250	.4715	822.8	1.761	.98381	20.23040	.15288	834.8	1.788	.99812	20.52474	.05180
44	270	3.000	.375	.7072	813.2	1.739	.97237	19.99516	.20047	828.4	1.773	.99049	20.36777	.11692
45	270	4.000	.500	.9430	731.9	1.556	.87513	17.99564	.44070	748.5	1.594	.89537	18.40555	.40112
46	90	1.000	.125	.2357	623.3	1.312	.74523	15.32440	.66200	626.4	1.319	.74895	15.40084	.65614
47	90	2.000	.250	.4715	610.5	1.283	.72994	15.01005	.68596	612.0	1.286	.73175	15.04725	.68314
48	90	3.000	.375	.7072	589.7	1.236	.70510	14.49924	.72452	592.8	1.243	.70882	14.57580	.71876
49	90	4.000	.500	.9430	529.0	1.099	.63249	13.00609	.83617	532.1	1.106	.63622	13.08286	.83042

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE IV.- DATA[a] FOR 140° CONE; $M_\infty = 4.63$

(a) $\alpha = 0°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 7892.1 psf					Φ = 22.5°, p_t = 7892.1 psf					Φ = 45.0°, p_t = 7882.6 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	632.8	1.749	.97102	27.25152	.20541	633.7	1.752	.97243	27.29132	.20023	632.7	1.751	.97205	27.28054	.20165
2	0	.200	.025	.0471	629.6	1.740	.96611	27.11389	.22247	630.5	1.743	.96752	27.15349	.21769	629.5	1.742	.96714	27.14276	.21899
3	0	.400	.050	.0943	628.0	1.736	.96366	27.04507	.23057	628.9	1.738	.96507	27.08457	.22595	627.9	1.738	.96469	27.07387	.22721
4	0	.600	.075	.1414	624.8	1.726	.95876	26.90744	.24603	625.7	1.729	.96016	26.94673	.24171	624.7	1.728	.95978	26.93609	.24289
5	0	.800	.100	.1886	620.0	1.713	.95140	26.70099	.26773	620.9	1.715	.95279	26.73998	.26376	621.5	1.719	.95487	26.79831	.25771
6	0	1.000	.125	.2357	616.8	1.704	.94650	26.56335	.28138	617.7	1.706	.94788	26.60215	.27759	615.7	1.705	.94750	26.59164	.27862
7	0	1.200	.150	.2829	612.0	1.690	.93914	26.35690	.30085	612.9	1.692	.94051	26.39539	.29730	611.9	1.692	.94014	26.38496	.29827
8	0	1.400	.175	.3300	608.8	1.681	.93424	26.21927	.31326	609.7	1.683	.93550	26.25756	.30985	608.7	1.682	.93523	26.24718	.31078
9	0	1.600	.200	.3772	605.6	1.671	.92933	26.08163	.32527	606.5	1.674	.93069	26.11972	.32199	603.9	1.669	.92787	26.04051	.32879
10	0	1.800	.225	.4243	600.8	1.658	.92198	25.87518	.34265	601.7	1.660	.92332	25.91297	.33952	600.7	1.660	.92296	25.90273	.34037
11	0	2.000	.250	.4715	596.0	1.644	.91462	25.66873	.35935	596.9	1.646	.91595	25.70627	.35637	595.9	1.646	.91559	25.69606	.35718
12	0	2.200	.275	.5186	591.2	1.630	.90726	25.46228	.37548	592.1	1.633	.90859	25.49947	.37261	591.1	1.632	.90823	25.48939	.37339
13	0	2.400	.300	.5658	586.4	1.616	.89991	25.25583	.39110	587.3	1.619	.90122	25.29271	.38834	584.7	1.614	.89841	25.21383	.39422
14	0	2.600	.325	.6129	580.0	1.598	.89010	24.98056	.41124	580.9	1.601	.89140	25.01705	.40861	580.0	1.600	.89105	25.00716	.40932
15	0	2.800	.350	.6601	573.6	1.580	.88029	24.70530	.43070	574.5	1.582	.88158	24.74138	.42819	573.6	1.581	.88123	24.73160	.42887
16	0	3.000	.375	.7072	565.7	1.557	.86803	24.36121	.45423	565.5	1.559	.86930	24.39679	.45184	564.0	1.554	.86650	24.31826	.45711
17	0	3.230	.400	.7544	556.1	1.529	.85332	23.94831	.48148	556.9	1.532	.85456	23.98328	.47920	554.4	1.526	.85177	23.90492	.48428
18	0	3.400	.425	.8015	544.9	1.497	.83615	23.46659	.51213	545.7	1.499	.83737	23.50086	.50999	543.2	1.494	.83459	23.42268	.51488
19	0	3.600	.450	.8487	530.5	1.456	.81408	22.84724	.55014	531.3	1.458	.81527	22.88060	.54812	530.4	1.458	.81495	22.87156	.54867
20	0	3.800	.475	.8958	511.3	1.401	.78466	22.02143	.59893	510.5	1.398	.78335	21.98468	.60106	509.7	1.398	.78304	21.97599	.60157
21	0	4.000	.500	.9430	479.4	1.309	.73562	20.64509	.67709	478.5	1.307	.73424	20.60633	.67925	477.7	1.306	.73395	20.59818	.67970
22	180	.200	.025	.0471	643.2	1.779	.98708	27.70246	.13640	641.9	1.776	.98498	27.64333	.14721	641.5	1.777	.98568	27.66314	.14368
23	180	.400	.050	.0943	638.4	1.766	.97974	27.49624	.17126	637.1	1.762	.97763	27.43704	.18008	638.4	1.768	.98078	27.52551	.16674
24	180	.600	.075	.1414	635.3	1.757	.97484	27.35876	.19115	633.9	1.753	.97273	27.29951	.19915	633.6	1.754	.97342	27.31907	.19654
25	180	.800	.100	.1886	632.1	1.747	.96994	27.22128	.20927	630.7	1.743	.96783	27.16198	.21665	628.8	1.740	.96607	27.11263	.22262
26	180	1.000	.125	.2357	628.9	1.738	.96504	27.08380	.22604	627.5	1.734	.96293	27.02445	.23294	625.6	1.731	.96116	26.97500	.23855
27	180	1.200	.150	.2829	624.1	1.725	.95769	26.87757	.24928	622.7	1.721	.95557	26.81815	.25562	623.8	1.717	.95381	26.76856	.26081
28	180	1.400	.175	.3300	620.9	1.715	.95279	26.74009	.26374	619.5	1.711	.95067	26.68063	.26979	617.6	1.708	.94890	26.63094	.27475
30	180	1.800	.225	.4243	612.9	1.692	.94055	26.39639	.29721	611.5	1.688	.93842	26.33680	.30269	609.6	1.685	.93664	26.28687	.30722
31	180	2.000	.250	.4715	609.7	1.683	.93565	26.25891	.30973	606.7	1.675	.93107	26.13051	.32105	604.8	1.671	.92929	26.08043	.32538
32	180	2.200	.275	.5186	604.9	1.670	.92830	26.05269	.32776	631.9	1.661	.92372	25.92422	.33859	630.1	1.658	.92193	25.87398	.34275
33	180	2.400	.300	.5658	598.5	1.651	.91850	25.77772	.35061	597.2	1.647	.91637	25.71792	.35543	595.3	1.644	.91458	25.66754	.35945
34	180	2.630	.325	.6129	593.8	1.637	.91115	25.57150	.36702	590.8	1.629	.90657	25.44286	.37697	588.9	1.626	.90477	25.39229	.38083
35	180	2.800	.350	.6601	587.4	1.619	.90136	25.29654	.38805	584.4	1.611	.89677	25.16781	.39762	582.5	1.607	.89496	25.11703	.40134
36	180	3.000	.375	.7072	579.4	1.596	.88911	24.95284	.41323	578.0	1.592	.88697	24.89275	.41752	574.5	1.584	.88270	24.77296	.42598
37	180	3.200	.400	.7544	569.8	1.569	.87441	24.54039	.44208	568.4	1.565	.87227	24.48016	.44619	566.5	1.561	.87044	24.42889	.44967
38	180	3.400	.425	.8015	558.6	1.537	.85727	24.05921	.47425	557.2	1.533	.85512	23.99881	.47819	555.4	1.529	.85328	23.94720	.48155
39	180	3.600	.450	.8487	544.3	1.495	.83523	23.44054	.51376	542.9	1.491	.83307	23.37993	.51754	541.0	1.488	.83121	23.32787	.52077
40	180	3.800	.475	.8958	526.7	1.445	.80828	22.68440	.55991	523.7	1.436	.80366	22.55476	.56763	521.9	1.433	.80179	22.50211	.57075
41	180	4.000	.500	.9430	494.8	1.353	.75930	21.30959	.63974	491.8	1.345	.75466	21.17947	.64710	489.9	1.341	.75275	21.12583	.65013
42	270	1.000	.125	.2357	625.7	1.729	.96014	26.94632	.24175	625.9	1.730	.96048	26.95568	.24071	627.2	1.736	.96362	27.04382	.23071
43	270	2.000	.250	.4715	603.3	1.665	.92585	25.98395	.33359	605.1	1.670	.92862	26.06175	.32698	606.4	1.676	.93174	26.14924	.31942
44	270	3.000	.375	.7072	573.0	1.578	.87931	24.67788	.43261	574.8	1.583	.88207	24.75522	.42722	576.1	1.589	.88515	24.84178	.42113
45	270	4.000	.500	.9430	490.0	1.340	.75195	21.10336	.65140	491.8	1.345	.75466	21.17947	.64710	493.1	1.350	.75765	21.26346	.64235
46	90	1.000	.125	.2357	515.2	1.699	.94404	26.49454	.28800	615.1	1.702	.94542	26.53323	.28429	615.1	1.701	.94505	26.52275	.28530
47	90	2.000	.250	.4715	594.4	1.639	.91217	25.59992	.36479	593.7	1.637	.91104	25.56838	.36726	594.3	1.641	.91314	25.62717	.36264
48	90	3.000	.375	.7072	562.5	1.548	.86313	24.22358	.46362	561.7	1.545	.86193	24.19004	.46565	562.4	1.549	.86404	24.24937	.46171
49	90	4.000	.500	.9430	477.8	1.305	.73317	20.57628	.68092	476.9	1.302	.73178	20.53741	.68309	477.7	1.306	.73395	20.59818	.67970

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE IV.- DATA[a] FOR 140° CONE; $M_\infty = 4.63$ - Continued

(a) $\alpha = 0°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 7882.6 psf					Φ = 90.0°, p_t = 7882.6 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	634.6	1.757	.97498	27.36274	.19060	634.2	1.756	.97437	27.34562	.19295
2	0	.200	.025	.0471	633.0	1.752	.97252	27.29382	.19990	632.6	1.751	.97192	27.27674	.20214
3	0	.400	.050	.0943	629.8	1.743	.96761	27.15597	.21739	631.0	1.747	.96946	27.20786	.21096
4	0	.600	.075	.1414	626.6	1.734	.96270	27.01812	.23367	626.2	1.733	.96210	27.00122	.23559
5	0	.800	.100	.1886	623.4	1.725	.95779	26.88028	.24898	623.0	1.724	.95719	26.86346	.25080
6	0	1.000	.125	.2357	618.6	1.711	.95042	26.67350	.27051	619.8	1.714	.95228	26.72570	.26522
7	0	1.200	.150	.2829	615.4	1.702	.94551	26.53566	.28406	615.0	1.701	.94492	26.51906	.28565
8	0	1.400	.175	.3300	610.6	1.688	.93814	26.32889	.30341	613.2	1.687	.93755	26.31241	.30491
9	0	1.600	.200	.3772	605.8	1.674	.93077	26.12211	.32178	605.4	1.673	.93019	26.10577	.32319
10	0	1.800	.225	.4243	602.6	1.665	.92586	25.98427	.33356	602.2	1.664	.92528	25.96801	.33493
11	0	2.000	.250	.4715	597.8	1.651	.91849	25.77750	.35063	595.8	1.646	.91547	25.69249	.35746
12	0	2.200	.275	.5186	591.4	1.633	.90867	25.50180	.37243	591.1	1.632	.90810	25.48585	.37366
13	0	2.400	.300	.5658	586.6	1.619	.90130	25.29503	.38817	586.3	1.618	.90074	25.27920	.38935
14	0	2.600	.325	.6129	580.2	1.601	.89148	25.01933	.40844	579.9	1.600	.89092	25.00368	.40957
15	0	2.800	.350	.6601	573.8	1.582	.88166	24.74364	.42803	571.9	1.577	.87865	24.65928	.43390
16	0	3.000	.375	.7072	565.8	1.559	.86938	24.39902	.45169	565.5	1.558	.86883	24.38376	.45272
17	0	3.200	.400	.7544	556.3	1.532	.85464	23.98548	.47906	555.9	1.531	.85411	23.97047	.48004
18	0	3.400	.425	.8015	545.1	1.500	.83745	23.50301	.50985	543.1	1.496	.83447	23.41943	.51508
19	0	3.600	.450	.8487	532.3	1.463	.81780	22.95162	.54383	530.4	1.457	.81484	22.86838	.54886
20	0	3.800	.475	.8958	511.5	1.403	.78588	22.05561	.59695	529.6	1.398	.78293	21.97293	.60174
21	0	4.000	.500	.9430	479.5	1.311	.73676	20.67714	.67530	477.6	1.306	.73385	20.59532	.67986
22	180	.200	.025	.0471	641.9	1.778	.98616	27.67661	.14123	641.5	1.777	.98555	27.65929	.14437
23	180	.400	.050	.0943	637.1	1.764	.97880	27.47007	.17521	636.7	1.763	.97819	27.45288	.17776
24	180	.600	.075	.1414	632.3	1.750	.97144	27.26353	.20386	631.9	1.749	.97084	27.24647	.20606
25	180	.800	.100	.1886	629.1	1.741	.96654	27.12583	.22104	628.7	1.740	.96593	27.10886	.22307
26	180	1.000	.125	.2357	624.3	1.727	.95918	26.91929	.24474	623.9	1.726	.95858	26.90245	.24658
27	180	1.200	.150	.2829	621.1	1.718	.95427	26.78159	.25945	619.1	1.712	.95122	26.69604	.26823
28	180	1.400	.175	.3300	616.3	1.704	.94691	26.57505	.28024	615.9	1.703	.94632	26.55843	.28186
30	180	1.600	.200	.3772	608.3	1.681	.93465	26.23082	.31223	606.4	1.676	.93161	26.14560	.31974
31	180	1.800	.225	.4243	603.5	1.668	.92729	26.02427	.33018	603.2	1.667	.92671	26.00799	.33156
32	180	2.000	.250	.4715	598.8	1.654	.91993	25.81773	.34736	598.4	1.653	.91935	25.80158	.34868
33	180	2.200	.275	.5186	594.0	1.640	.91257	25.61119	.36390	592.0	1.634	.90955	25.52636	.37053
34	180	2.400	.300	.5658	589.2	1.626	.90521	25.40465	.37989	585.6	1.616	.89974	25.25115	.39144
35	180	2.600	.325	.6129	581.2	1.603	.89294	25.06041	.40547	579.2	1.598	.88993	24.97593	.41157
36	180	2.800	.350	.6601	573.2	1.580	.88068	24.71618	.42995	571.3	1.575	.87768	24.63191	.43579
37	180	3.000	.375	.7072	565.2	1.558	.86841	24.37194	.45351	561.7	1.547	.86297	24.21908	.46372
38	180	3.200	.400	.7544	554.0	1.525	.85124	23.89001	.48525	550.5	1.515	.84580	23.73765	.49503
39	180	3.400	.425	.8015	539.7	1.484	.82916	23.27038	.52433	535.1	1.474	.82374	23.11822	.53368
40	180	3.600	.450	.8487	520.5	1.429	.79972	22.44422	.57418	517.0	1.419	.79432	22.29257	.58311
41	180	3.800	.475	.8958	488.6	1.337	.75066	21.06727	.65343	485.1	1.327	.74529	20.91648	.66191
42	180	4.000	.500	.9430	429.1	1.741	.96654	27.12583	.22104	628.7	1.740	.96593	27.10886	.22307
43	270	1.000	.125	.2357	611.5	1.691	.93955	26.36851	.29978	639.5	1.685	.93651	26.28321	.30755
44	270	2.000	.250	.4715	579.6	1.599	.89049	24.99157	.41045	580.8	1.602	.89239	25.04473	.40661
45	270	3.000	.375	.7072	495.0	1.356	.76047	21.34266	.63786	494.7	1.355	.75000	21.32931	.63862
46	270	4.000	.500	.9430	617.0	1.706	.94796	26.60458	.27735	618.2	1.710	.94983	26.65682	.27218
47	90	1.000	.125	.2357	596.2	1.647	.91604	25.70857	.35618	597.4	1.650	.91792	25.76137	.35194
48	90	2.000	.250	.4715	565.8	1.559	.86938	24.39902	.45169	565.5	1.558	.86883	24.38376	.45272
49	90	3.000	.375	.7072	481.1	1.316	.73922	20.74606	.67145	482.4	1.320	.74121	20.80196	.66832
	90	4.000	.500	.9430										

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE IV.- DATA[a] FOR 140° CONE; $M_\infty = 4.63$ - Continued

(b) $\alpha = 5°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 7892.1 psf					Φ = 22.5°, p_t = 7882.6 psf					Φ = 45.0°, p_t = 7882.6 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	624.6	1.726	.95856	26.90183	.24665	625.6	1.731	.96125	26.97730	.23830	626.5	1.734	.96263	27.01625	.23388
2	0	.200	.025	.0471	611.9	1.689	.93894	26.35140	.30135	614.4	1.699	.94404	26.49433	.28801	617.0	1.706	.94790	26.60273	.27754
3	0	.400	.050	.0943	608.7	1.680	.93404	26.21380	.31374	609.6	1.685	.93666	26.28734	.30717	613.8	1.697	.94299	26.46489	.29080
4	0	.600	.075	.1414	605.5	1.671	.92914	26.07619	.32574	606.4	1.676	.93174	26.14935	.31941	609.0	1.683	.93562	26.25814	.30980
5	0	.800	.100	.1886	600.7	1.657	.92178	25.86979	.34310	603.2	1.667	.92683	26.01136	.33127	605.8	1.674	.93071	26.12030	.32194
6	0	1.000	.125	.2357	595.9	1.644	.91443	25.66338	.35978	598.4	1.653	.91945	25.80437	.34845	601.0	1.660	.92334	25.91354	.33948
7	0	1.200	.150	.2829	591.1	1.630	.90707	25.45697	.37589	593.6	1.639	.91208	25.59739	.36499	595.2	1.646	.91598	25.70678	.35632
8	0	1.400	.175	.3300	585.3	1.616	.89972	25.25056	.39149	587.2	1.621	.90224	25.32141	.38619	593.0	1.637	.91106	25.56895	.36722
9	0	1.600	.200	.3772	581.5	1.602	.89236	25.04415	.40665	582.4	1.607	.89487	25.11442	.40153	588.2	1.624	.90370	25.36219	.38311
10	0	1.800	.225	.4243	576.7	1.589	.88501	24.83775	.42141	579.2	1.598	.88995	24.97643	.41153	583.4	1.610	.89633	25.15543	.39853
11	0	2.000	.250	.4715	571.9	1.575	.87766	24.63134	.43583	574.4	1.584	.88258	24.76944	.42622	578.6	1.596	.88896	24.94868	.41352
12	0	2.200	.275	.5186	567.1	1.561	.87030	24.42493	.44994	568.0	1.566	.87274	24.49346	.44529	573.8	1.582	.88160	24.74192	.42815
13	0	2.400	.300	.5658	562.3	1.547	.86295	24.21852	.46376	563.2	1.552	.86537	24.28647	.45924	567.4	1.564	.87177	24.46624	.44714
14	0	2.600	.325	.6129	555.9	1.529	.85314	23.94331	.48180	556.8	1.533	.85553	24.01049	.47743	561.0	1.545	.86195	24.19057	.46561
15	0	2.800	.350	.6601	548.0	1.506	.84088	23.59930	.50379	548.8	1.510	.84324	23.66551	.49961	554.6	1.527	.85213	23.91489	.48364
16	0	3.000	.375	.7072	540.0	1.483	.82862	23.25529	.52526	540.8	1.487	.83095	23.32053	.52123	546.6	1.504	.83985	23.57030	.50562
17	0	3.200	.400	.7544	532.0	1.460	.81637	22.91127	.54627	532.8	1.464	.81866	22.97555	.54238	537.0	1.477	.82511	23.15678	.53132
18	0	3.400	.425	.8015	520.8	1.428	.79921	22.42965	.57504	521.6	1.432	.80145	22.49258	.57132	525.9	1.444	.80792	22.67435	.56051
19	0	3.600	.450	.8487	508.0	1.391	.77959	21.87923	.60716	508.8	1.395	.78178	21.94062	.60362	513.1	1.408	.78828	22.12300	.59303
20	0	3.800	.475	.8958	488.9	1.336	.75017	21.05360	.65420	489.6	1.340	.75228	21.11267	.65087	493.9	1.353	.75881	21.29597	.64051
21	0	4.000	.500	.9430	458.5	1.249	.70360	19.74635	.72685	459.2	1.253	.70557	19.80175	.72380	463.5	1.265	.71215	19.98651	.71361
22	180	.200	.025	.0471	644.7	1.784	.98933	27.76541	.12390	645.0	1.787	.99100	27.81237	.11372	640.9	1.775	.98473	27.63652	.14841
23	180	.400	.050	.0943	644.7	1.784	.98933	27.76541	.12390	645.0	1.787	.99100	27.81237	.11372	639.3	1.770	.98228	27.56760	.16003
24	180	.600	.075	.1414	643.1	1.779	.98688	27.69668	.13750	643.4	1.782	.98855	27.74353	.12838	637.7	1.766	.97982	27.49868	.17089
25	180	.800	.100	.1886	641.5	1.775	.98443	27.62796	.14990	641.8	1.778	.98609	27.67469	.14158	634.5	1.757	.97491	27.36084	.19087
26	180	1.000	.125	.2357	639.9	1.770	.98198	27.55923	.16138	638.6	1.768	.98119	27.53700	.16493	631.3	1.748	.97000	27.22300	.20905
27	180	1.200	.150	.2829	636.7	1.761	.97708	27.42178	.18229	635.4	1.759	.97628	27.39932	.18549	628.1	1.738	.96509	27.08516	.22588
28	180	1.400	.175	.3300	633.5	1.752	.97219	27.28433	.20115	632.2	1.750	.97138	27.26163	.20411	624.9	1.729	.96018	26.94733	.24164
30	180	1.800	.225	.4243	625.5	1.729	.95994	26.94069	.24238	524.3	1.727	.95911	26.91742	.24494	618.6	1.711	.95035	26.67165	.27069
31	180	2.000	.250	.4715	622.4	1.720	.95504	26.80324	.25719	622.7	1.723	.95666	26.84858	.25239	613.8	1.697	.94299	26.46489	.29080
32	180	2.200	.275	.5186	617.6	1.706	.94770	26.59706	.27809	617.9	1.709	.94930	26.64205	.27365	610.6	1.688	.93808	26.32706	.30358
33	180	2.400	.300	.5658	614.4	1.697	.94280	26.45961	.29130	613.1	1.695	.94194	26.43552	.29357	605.8	1.674	.93071	26.12030	.32194
34	180	2.600	.325	.6129	609.6	1.683	.93545	26.25343	.31022	608.3	1.681	.93458	26.22899	.31240	601.0	1.660	.92334	25.91354	.33948
35	180	2.800	.350	.6601	603.2	1.665	.92566	25.97853	.33404	601.9	1.663	.92477	25.95362	.33613	593.0	1.637	.91106	25.56895	.36722
36	180	3.000	.375	.7072	596.8	1.646	.91586	25.70362	.35658	595.5	1.645	.91496	25.67825	.35860	586.6	1.619	.90124	25.29327	.38830
37	180	3.200	.400	.7544	588.8	1.623	.90362	25.35999	.38328	585.9	1.617	.90024	25.26520	.39040	577.0	1.591	.88651	24.87976	.41844
38	180	3.400	.425	.8015	577.7	1.591	.88648	24.87891	.41850	576.4	1.590	.88552	24.85214	.42040	567.4	1.564	.87177	24.46624	.44714
39	180	3.600	.450	.8487	563.3	1.550	.86444	24.26037	.46098	562.0	1.548	.86345	24.23256	.46283	553.0	1.522	.84967	23.84597	.48808
40	180	3.800	.475	.8958	545.8	1.500	.83750	23.50438	.50977	542.8	1.493	.83401	23.40645	.51589	535.4	1.472	.82266	23.08786	.53554
41	180	4.000	.500	.9430	510.7	1.399	.78363	21.99240	.60062	510.9	1.401	.78495	22.02960	.59846	501.9	1.376	.77109	21.64056	.62088
42	270	1.000	.125	.2357	619.2	1.710	.95015	26.66579	.27128	629.0	1.741	.96647	27.12395	.22127	634.5	1.757	.97491	27.36084	.19087
43	270	2.000	.250	.4715	598.4	1.651	.91831	25.77235	.35105	609.9	1.686	.93704	26.29784	.30623	617.0	1.706	.94790	26.60273	.27754
44	270	3.000	.375	.7072	569.7	1.568	.87423	24.53527	.44243	581.1	1.603	.89288	25.05867	.40559	588.2	1.624	.90370	25.36219	.38311
45	270	4.000	.500	.9430	488.3	1.335	.74934	21.03024	.65551	496.5	1.360	.76287	21.41002	.63404	505.1	1.385	.77600	21.77840	.61297
46	90	1.000	.125	.2357	608.7	1.680	.93404	26.21380	.31374	603.2	1.667	.92683	26.01136	.33127	599.4	1.656	.92089	25.84462	.34516
47	90	2.000	.250	.4715	587.9	1.621	.90217	25.31937	.38634	582.4	1.607	.89487	25.11442	.40153	578.6	1.596	.88896	24.94868	.41352
48	90	3.000	.375	.7072	557.5	1.534	.85559	24.01212	.47733	550.4	1.515	.84570	23.73451	.49522	546.6	1.504	.83985	23.57030	.50562
49	90	4.000	.500	.9430	474.5	1.295	.72811	20.43438	.68882	468.8	1.281	.72032	20.21573	.70095	466.7	1.274	.71706	20.12435	.70600

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.
Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE IV.- DATA[a] FOR 140°-CONE; $M_\infty = 4.63$ - Continued

(b) $\alpha = 5°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 7882.6 psf					Φ = 90.0°, p_t = 7882.6 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	625.5	1.731	.96105	26.97167	.23893	626.5	1.734	.96263	27.01625	.23388
2	0	.230	.025	.0471	619.1	1.712	.95121	26.69575	.26826	624.9	1.729	.96018	26.94733	.24164
3	0	.400	.050	.0943	615.9	1.703	.94630	26.55779	.28192	623.3	1.725	.95772	26.87841	.24919
4	0	.630	.075	.1414	612.7	1.694	.94138	26.41982	.29503	620.2	1.715	.95281	26.74057	.26370
5	0	.930	.100	.1886	609.5	1.685	.93647	26.28186	.30767	617.0	1.706	.94790	26.60273	.27754
6	0	1.000	.125	.2357	606.3	1.676	.93155	26.14390	.31988	613.8	1.697	.94299	26.46489	.29080
7	0	1.200	.150	.2829	601.5	1.662	.92418	25.93696	.33753	609.0	1.683	.93562	26.25814	.30980
8	0	1.400	.175	.3300	596.7	1.648	.91680	25.73001	.35446	605.8	1.674	.93071	26.12030	.32194
9	0	1.600	.200	.3772	593.5	1.639	.91189	25.59205	.36541	601.0	1.660	.92334	25.91356	.33948
10	0	1.830	.225	.4243	587.1	1.620	.90206	25.31612	.38658	597.8	1.651	.91843	25.77570	.35078
11	0	2.000	.250	.4715	583.9	1.611	.89714	25.17816	.39685	593.0	1.637	.91106	25.56895	.36722
12	0	2.200	.275	.5186	579.1	1.597	.88977	24.97122	.41191	588.2	1.624	.90370	25.36219	.38311
13	0	2.400	.300	.5658	572.7	1.579	.87993	24.69529	.43140	583.4	1.610	.89633	25.15543	.39853
14	0	2.630	.325	.6129	567.9	1.565	.87256	24.48835	.44563	577.0	1.591	.88651	24.87976	.41844
15	0	2.800	.350	.6601	561.5	1.547	.86273	24.21242	.46416	570.6	1.573	.87668	24.60408	.43771
16	0	3.000	.375	.7072	553.5	1.524	.85044	23.86752	.48670	562.6	1.550	.86441	24.25949	.46104
17	0	3.200	.400	.7544	543.9	1.496	.83569	23.45363	.51294	553.0	1.522	.84967	23.84597	.48808
18	0	3.430	.425	.8015	532.7	1.464	.81849	22.97076	.54267	541.8	1.490	.83248	23.36354	.51856
19	0	3.600	.450	.8487	518.3	1.423	.79636	22.34993	.57974	527.4	1.449	.81038	22.74327	.55639
20	0	3.800	.475	.8958	499.1	1.368	.76687	21.52215	.62765	508.3	1.394	.78091	21.91624	.60503
21	0	4.000	.500	.9430	468.7	1.280	.72017	20.21151	.70118	476.3	1.302	.73180	20.53786	.68306
22	180	.200	.025	.0471	636.9	1.763	.97853	27.46243	.17635	631.5	1.748	.97030	27.23141	.20798
23	180	.400	.050	.0943	633.7	1.754	.97363	27.32477	.19578	626.8	1.734	.96295	27.02511	.23287
24	180	.600	.075	.1414	630.5	1.745	.96872	27.18712	.21355	625.2	1.730	.96050	26.95634	.24064
25	180	.830	.100	.1886	627.3	1.736	.96382	27.04946	.23006	620.4	1.716	.95315	26.75004	.26272
26	180	1.000	.125	.2357	625.7	1.731	.96136	26.98063	.23792	617.2	1.707	.94825	26.61251	.27657
27	180	1.230	.150	.2829	620.9	1.718	.95401	26.77415	.26023	514.0	1.698	.94335	26.47498	.28985
28	180	1.400	.175	.3300	617.7	1.708	.94910	26.63649	.27420	609.2	1.684	.93600	26.26868	.30885
29	180	1.600	.200	.3772	609.8	1.686	.93684	26.29235	.30672	601.2	1.661	.92375	25.92485	.33854
30	180	1.830	.225	.4243	606.6	1.676	.93193	26.15469	.31894	598.0	1.652	.91884	25.78732	.34986
31	180	2.000	.250	.4715	601.8	1.663	.92458	25.94821	.33659	591.7	1.634	.90904	25.51225	.37162
32	180	2.230	.275	.5186	595.4	1.644	.91477	25.67290	.35902	585.9	1.620	.90189	25.30595	.38735
33	180	2.400	.300	.5658	590.6	1.630	.90741	25.46641	.37516	580.5	1.601	.89189	25.03089	.40761
34	180	2.600	.325	.6129	584.2	1.612	.89760	25.19110	.39590	574.1	1.583	.88209	24.75582	.42718
35	180	2.800	.350	.6601	576.2	1.589	.88534	24.84696	.42076	566.2	1.560	.86984	24.41199	.45081
36	180	3.000	.375	.7072	566.7	1.562	.87062	24.43399	.44932	556.6	1.533	.85514	23.99940	.47816
37	180	3.230	.400	.7544	557.1	1.534	.85591	24.02102	.47675	547.0	1.505	.84044	23.58680	.50458
38	180	3.400	.425	.8015	542.7	1.493	.83384	23.40157	.51619	532.7	1.464	.81838	22.96790	.54284
39	180	3.630	.450	.8487	523.6	1.438	.80441	22.57563	.56639	513.5	1.409	.78898	22.14271	.59188
40	180	3.800	.475	.8958	491.6	1.346	.75536	21.19907	.64599	481.6	1.317	.73998	20.76739	.67026
41	180	4.000	.500	.9430	440.1	1.773	.98344	27.60009	.15465	641.1	1.776	.98500	27.64400	.14709
42	270	1.000	.125	.2357	624.1	1.727	.95891	26.91180	.24556	625.2	1.730	.96050	26.95634	.24064
43	270	2.000	.250	.4715	597.0	1.649	.91722	25.74173	.35352	598.0	1.652	.91884	25.78732	.34984
44	270	3.000	.375	.7072	514.0	1.410	.78969	22.16266	.59071	515.7	1.418	.79388	22.28024	.58383
45	270	4.000	.500	.9430	596.7	1.648	.91680	25.73001	.35446	596.2	1.646	.91598	25.70678	.35632
46	90	1.000	.125	.2357	572.7	1.579	.87993	24.69529	.43140	573.8	1.582	.88160	24.74192	.42815
47	90	2.000	.250	.4715	542.3	1.492	.83323	23.38465	.51725	541.8	1.490	.83248	23.36354	.51856
48	90	3.000	.375	.7072	462.3	1.262	.71034	19.93559	.71642	461.9	1.261	.70970	19.91759	.71742
49	90	4.000	.500	.9430										

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE IV.- DATA[a] FOR 140° CONE; $M_\infty = 4.63$ - Continued

(c) $\alpha = 10°$

Orifice	e, deg	s, in.	s/D	s/s*	$\Phi = 0.0°$, $p_t = 7892.1$ psf					$\Phi = 22.5°$, $p_t = 7882.6$ psf					$\Phi = 45.0°$, $p_t = 7892.1$ psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	596.2	1.644	.91487	25.67587	.35879	595.1	1.643	.91434	25.66103	.35997	596.1	1.644	.91475	25.67230	.35907
2	0	.230	.025	.0471	573.8	1.580	.88054	24.71217	.43023	574.3	1.584	.88239	24.76427	.42658	578.5	1.594	.88777	24.91521	.41592
3	0	.430	.050	.0943	573.8	1.580	.88054	24.71217	.43023	574.3	1.584	.88239	24.76427	.42658	576.9	1.589	.88532	24.84638	.42080
4	0	.630	.075	.1414	572.2	1.576	.87808	24.64333	.43500	572.7	1.579	.87993	24.69529	.43140	573.7	1.580	.88041	24.70873	.43047
5	0	.800	.100	.1886	569.0	1.566	.87318	24.50566	.44446	567.9	1.565	.87256	24.48835	.44563	570.5	1.571	.87551	24.57108	.43998
6	0	1.000	.125	.2357	564.2	1.553	.86582	24.29915	.45839	564.7	1.556	.86764	24.35039	.45496	567.3	1.562	.87060	24.43342	.44936
7	0	1.200	.150	.2829	557.8	1.534	.85601	24.02381	.47657	559.9	1.542	.86027	24.14344	.46872	562.5	1.548	.86325	24.22695	.46320
8	0	1.400	.175	.3300	554.6	1.525	.85110	23.88613	.48550	555.1	1.529	.85290	23.93650	.48224	559.3	1.539	.85834	24.08929	.47228
9	0	1.600	.200	.3772	549.8	1.511	.84374	23.67963	.49871	551.9	1.519	.84798	23.79854	.49113	556.1	1.530	.85344	23.95164	.48126
10	0	1.800	.225	.4243	545.0	1.498	.83639	23.47312	.51173	547.1	1.506	.84061	23.59159	.50428	551.3	1.516	.84608	23.74516	.49454
11	0	2.000	.250	.4715	541.8	1.488	.83148	23.33544	.52030	542.3	1.492	.83323	23.38465	.51725	548.2	1.507	.84117	23.60751	.50328
12	0	2.200	.275	.5186	537.0	1.475	.82412	23.12894	.53303	537.5	1.478	.82586	23.17771	.53004	543.4	1.493	.83382	23.40103	.51623
13	0	2.400	.300	.5658	532.2	1.461	.81676	22.92243	.54560	532.7	1.464	.81849	22.97076	.54267	538.6	1.479	.82646	23.19455	.52900
14	0	2.600	.325	.6129	525.9	1.443	.80695	22.66708	.56214	527.9	1.450	.81111	22.76382	.55515	532.2	1.461	.81665	22.91924	.54579
15	0	2.800	.350	.6601	519.5	1.424	.79714	22.37174	.57845	521.5	1.432	.80128	22.48789	.57160	525.8	1.442	.80684	22.64393	.56232
16	0	3.300	.375	.7072	513.1	1.406	.78733	22.09639	.59457	515.1	1.414	.79145	22.21197	.58783	519.4	1.424	.79703	22.36863	.57864
17	0	3.200	.400	.7544	505.1	1.383	.77507	21.75221	.61448	505.5	1.386	.77670	21.79808	.61184	511.4	1.401	.78477	22.02450	.59875
18	0	3.400	.425	.8015	495.5	1.355	.76035	21.33920	.63806	495.9	1.358	.76195	21.38419	.63551	501.8	1.374	.77005	21.61154	.62255
19	0	3.600	.450	.8487	482.7	1.319	.74073	20.78851	.66908	483.1	1.322	.74229	20.83234	.66662	489.0	1.337	.75044	21.06092	.65379
20	0	3.800	.475	.8958	466.7	1.273	.71620	20.10015	.70734	467.1	1.276	.71771	20.14253	.70500	471.4	1.286	.72346	20.30383	.69606
21	0	4.000	.500	.9430	441.1	1.199	.67696	18.99877	.76786	439.9	1.198	.67593	18.96985	.76944	444.3	1.208	.68177	19.13378	.76046
22	180	.200	.025	.0471	630.6	1.743	.96776	27.16009	.21688	627.3	1.736	.96382	27.04946	.23006	618.5	1.708	.94908	26.63587	.27426
23	180	.430	.050	.0943	640.2	1.771	.98246	27.57265	.15920	635.3	1.759	.97608	27.39360	.18630	624.9	1.727	.95889	26.91118	.24562
24	180	.600	.075	.1414	643.4	1.780	.98736	27.71017	.13493	638.5	1.768	.98098	27.53126	.16584	628.1	1.736	.96379	27.04883	.23013
25	180	.800	.100	.1886	645.0	1.785	.98981	27.77893	.12106	638.5	1.768	.98098	27.53126	.16584	628.1	1.736	.96379	27.04883	.23013
26	180	1.000	.125	.2357	645.0	1.785	.98981	27.77893	.12106	638.5	1.768	.98098	27.53126	.16584	626.5	1.731	.96134	26.98001	.23799
27	180	1.230	.150	.2829	645.0	1.785	.98981	27.77893	.12106	638.5	1.768	.98098	27.53126	.16584	624.9	1.727	.95889	26.91118	.24562
28	180	1.400	.175	.3300	643.4	1.780	.98736	27.71017	.13493	636.9	1.763	.97853	27.46243	.17635	623.3	1.722	.95644	26.84235	.25305
30	180	1.800	.225	.4243	638.6	1.766	.98001	27.50389	.17009	633.7	1.754	.97363	27.32477	.19578	618.5	1.708	.94908	26.63587	.27426
31	180	2.000	.250	.4715	637.0	1.762	.97756	27.43513	.18036	630.5	1.745	.96872	27.18712	.21355	616.9	1.704	.94663	26.56705	.28102
32	180	2.230	.275	.5186	633.8	1.752	.97266	27.29761	.19940	627.3	1.736	.96382	27.04946	.23006	613.7	1.695	.94172	26.42939	.29414
33	180	2.400	.300	.5658	630.6	1.743	.96776	27.16009	.21688	624.1	1.727	.95891	26.91180	.24555	608.9	1.681	.93437	26.22292	.31294
34	180	2.600	.325	.6129	625.9	1.730	.96041	26.95381	.24092	619.3	1.713	.95155	26.70532	.26729	605.7	1.672	.92946	26.08526	.32496
35	180	2.800	.350	.6601	621.1	1.716	.95306	26.74753	.26298	614.5	1.699	.94420	26.49884	.28759	599.3	1.653	.91965	25.80996	.34800
36	180	3.000	.375	.7072	614.7	1.698	.94326	26.47249	.29009	608.2	1.681	.93439	26.22352	.31288	592.9	1.635	.90984	25.53465	.36989
37	180	3.200	.400	.7544	608.3	1.679	.93346	26.19745	.31519	630.2	1.658	.92212	25.87938	.34230	584.9	1.612	.89758	25.19052	.39594
38	180	3.400	.425	.8015	598.7	1.652	.91876	25.78489	.35003	590.6	1.630	.90741	25.46641	.37516	575.3	1.585	.88287	24.77756	.42565
39	180	3.600	.450	.8487	584.3	1.610	.89671	25.18606	.39775	576.2	1.589	.88534	24.84696	.42076	562.5	1.548	.86325	24.22695	.46320
40	180	3.800	.475	.8958	566.8	1.560	.86976	24.40970	.45097	558.7	1.539	.85836	24.08985	.47225	543.4	1.493	.83382	23.40103	.51623
41	180	4.000	.500	.9430	533.3	1.464	.81831	22.96575	.54297	526.8	1.447	.80931	22.71329	.55818	511.4	1.401	.78477	22.02450	.59875
42	270	1.000	.125	.2357	598.7	1.652	.91876	25.78489	.35003	614.5	1.699	.94420	26.49884	.28759	629.7	1.741	.96625	27.11766	.22202
43	270	2.000	.250	.4715	582.7	1.606	.89426	25.09730	.40278	601.8	1.663	.92458	25.94821	.33659	620.1	1.713	.95153	26.70470	.26736
44	270	3.000	.375	.7072	558.8	1.537	.85751	24.06590	.47382	576.2	1.589	.88534	24.84696	.42076	596.1	1.644	.91475	25.67230	.35907
45	270	4.000	.500	.9430	479.0	1.308	.73501	20.62792	.67805	498.0	1.364	.76517	21.47438	.63038	515.2	1.415	.79213	22.23098	.58672
46	90	1.000	.125	.2357	586.6	1.617	.90016	25.26286	.39057	574.3	1.584	.88239	24.76427	.42658	565.7	1.557	.86815	24.36460	.45401
47	90	2.000	.250	.4715	572.2	1.576	.87808	24.64333	.43500	556.7	1.533	.85535	24.00548	.47776	546.6	1.502	.83872	23.53868	.50761
48	90	3.000	.375	.7072	545.0	1.498	.83639	23.47312	.51173	529.5	1.455	.81357	22.83280	.55101	519.4	1.424	.79703	22.36863	.57864
49	90	4.000	.500	.9430	465.1	1.268	.71375	20.03131	.71114	454.3	1.239	.69805	19.59068	.73541	445.9	1.213	.68422	19.20261	.75669

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE IV.- DATA[a] FOR 140° CONE; $M_\infty = 4.63$ - Continued

(c) $\alpha = 10°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 7882.6 psf					Φ = 90.0°, p_t = 7882.6 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	595.2	1.644	.91447	25.66460	.35968	595.9	1.646	.91553	25.69428	.35732
2	0	.200	.025	.0471	584.0	1.611	.89726	25.18166	.39659	592.7	1.636	.91062	25.55650	.36819
3	0	.400	.050	.0943	582.4	1.607	.89481	25.11267	.40166	592.7	1.636	.91062	25.55650	.36819
4	0	.600	.075	.1414	582.4	1.607	.89481	25.11267	.40166	592.7	1.636	.91062	25.55650	.36819
5	0	.800	.100	.1886	579.2	1.598	.88989	24.97469	.41166	591.1	1.632	.90817	25.48762	.37353
6	0	1.000	.125	.2357	576.0	1.588	.88497	24.83671	.42149	589.5	1.627	.90571	25.41873	.37881
7	0	1.230	.150	.2829	572.8	1.579	.88006	24.69873	.43116	586.3	1.618	.90080	25.28096	.38922
8	0	1.400	.175	.3300	569.6	1.570	.87514	24.56075	.44069	584.7	1.614	.89835	25.21208	.39435
9	0	1.600	.200	.3772	566.4	1.561	.87022	24.42276	.45008	581.5	1.604	.89344	25.07431	.40446
10	0	1.800	.225	.4243	563.2	1.552	.86531	24.28478	.45935	578.3	1.595	.88853	24.93653	.41439
11	0	2.000	.250	.4715	558.4	1.538	.85793	24.07781	.47304	575.1	1.586	.88362	24.79876	.42416
12	0	2.200	.275	.5186	555.2	1.529	.85302	23.93983	.48202	570.3	1.572	.87626	24.59211	.43854
13	0	2.400	.300	.5658	550.4	1.515	.84564	23.73286	.49532	567.1	1.563	.87135	24.45434	.44795
14	0	2.630	.325	.6129	545.6	1.501	.83827	23.52588	.50842	560.7	1.545	.86153	24.17879	.46639
15	0	2.800	.350	.6601	539.2	1.483	.82843	23.24992	.52559	555.9	1.531	.85417	23.97214	.47993
16	0	3.000	.375	.7072	532.8	1.464	.81860	22.97396	.54247	548.0	1.508	.84189	23.62771	.50200
17	0	3.230	.400	.7544	523.2	1.437	.80385	22.56001	.56732	540.0	1.485	.82962	23.28328	.52353
18	0	3.400	.425	.8015	513.6	1.409	.78910	22.14607	.59168	530.4	1.457	.81489	22.86997	.54877
19	0	3.600	.450	.8487	500.8	1.372	.76943	21.59414	.62354	516.0	1.416	.79280	22.25000	.58560
20	0	3.800	.475	.8958	481.6	1.317	.73994	20.76625	.67032	496.8	1.361	.76335	21.42338	.63328
21	0	4.000	.500	.9430	452.8	1.234	.69569	19.52441	.73905	466.5	1.274	.71671	20.11455	.70654
22	180	.200	.025	.0471	612.1	1.692	.94047	26.39414	.29742	602.5	1.665	.92574	25.98097	.33384
23	180	.400	.050	.0943	612.1	1.692	.94047	26.39414	.29742	599.3	1.656	.92085	25.84350	.34526
24	180	.600	.075	.1414	613.7	1.697	.94292	26.46305	.29098	597.8	1.651	.91840	25.77477	.35085
25	180	.800	.100	.1886	612.1	1.692	.94047	26.39414	.29742	596.2	1.646	.91595	25.70604	.35638
26	180	1.000	.125	.2357	612.1	1.692	.94047	26.39414	.29742	594.6	1.642	.91350	25.63730	.36184
27	180	1.200	.150	.2829	608.9	1.683	.93556	26.25631	.30996	591.4	1.633	.90860	25.49984	.37258
28	180	1.400	.175	.3300	607.3	1.679	.93310	26.18740	.31607	588.2	1.624	.90370	25.36237	.38310
30	180	1.800	.225	.4243	602.5	1.665	.92573	25.98065	.33386	583.4	1.610	.89636	25.15617	.39847
31	180	2.000	.250	.4715	599.3	1.656	.92082	25.84283	.34531	580.2	1.601	.89146	25.01871	.40849
32	180	2.200	.275	.5186	594.5	1.642	.91346	25.63608	.36194	575.4	1.587	.88411	24.81251	.42320
33	180	2.400	.300	.5658	591.3	1.633	.90854	25.49825	.37271	570.7	1.573	.87676	24.60631	.43756
34	180	2.600	.325	.6129	586.5	1.619	.90118	25.29151	.38843	565.9	1.559	.86942	24.40011	.45161
35	180	2.800	.350	.6601	580.2	1.600	.89136	25.01586	.40869	559.5	1.541	.85962	24.12518	.46993
36	180	3.000	.375	.7072	573.8	1.582	.88153	24.74020	.42827	551.5	1.518	.84737	23.78152	.49222
37	180	3.230	.400	.7544	565.8	1.559	.86926	24.39563	.45192	543.6	1.495	.83513	23.43786	.51393
38	180	3.400	.425	.8015	556.2	1.532	.85452	23.98214	.47928	534.0	1.468	.82044	23.02546	.53934
39	180	3.600	.450	.8487	541.8	1.490	.83242	23.36191	.51866	521.2	1.431	.80084	22.47560	.57232
40	180	3.800	.475	.8958	524.2	1.440	.80541	22.60386	.56471	503.7	1.381	.77390	21.71954	.61636
41	180	4.000	.500	.9430	492.3	1.348	.75630	21.22557	.64450	471.8	1.289	.72492	20.34488	.69379
42	270	1.000	.125	.2357	642.5	1.780	.98712	27.70351	.13620	645.6	1.788	.99187	27.83675	.10806
43	270	2.000	.250	.4715	634.5	1.757	.97484	27.35894	.19113	637.6	1.766	.97962	27.49309	.17174
44	270	3.000	.375	.7072	612.1	1.692	.94047	26.39414	.29742	615.3	1.701	.94534	26.53083	.28452
45	270	4.000	.500	.9430	532.2	1.463	.81769	22.94843	.54402	535.6	1.472	.82288	23.09419	.53515
46	90	1.000	.125	.2357	564.8	1.556	.86777	24.35377	.45673	563.9	1.554	.86644	24.31657	.45723
47	90	2.000	.250	.4715	542.4	1.492	.83335	23.38790	.51704	541.6	1.490	.83208	23.35217	.51926
48	90	3.000	.375	.7072	515.2	1.414	.79156	22.21506	.58765	512.8	1.407	.78790	22.11223	.59365
49	90	4.000	.500	.9430	443.2	1.207	.68094	19.11047	.76174	442.5	1.205	.67990	19.08127	.76334

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE IV.- DATA[a] FOR 140° CONE; $M_\infty = 4.63$ - Continued

(d) $\alpha = 15°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 7892.1 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	563.4	1.493	.83382	23.40103	.51623
2	0	.200	.025	.0471	511.4	1.401	.78477	22.02450	.59875
3	0	.400	.050	.0943	519.4	1.424	.79703	22.36863	.57864
4	0	.600	.075	.1414	522.6	1.433	.80194	22.50628	.57051
5	0	.800	.100	.1886	521.0	1.429	.79948	22.43745	.57458
6	0	1.000	.125	.2357	517.8	1.419	.79458	22.29980	.58268
7	0	1.200	.150	.2829	514.6	1.410	.78967	22.16215	.59074
8	0	1.400	.175	.3300	511.4	1.401	.78477	22.02450	.59875
9	0	1.600	.200	.3772	508.2	1.392	.77986	21.88684	.60672
10	0	1.800	.225	.4243	505.0	1.383	.77496	21.74919	.61465
11	0	2.000	.250	.4715	501.8	1.374	.77005	21.61154	.62255
12	0	2.200	.275	.5186	498.6	1.364	.76515	21.47388	.63040
13	0	2.400	.300	.5658	495.4	1.355	.76024	21.33623	.63823
14	0	2.530	.325	.6129	490.6	1.341	.75289	21.12975	.64991
15	0	2.800	.350	.6601	485.8	1.328	.74553	20.92327	.66152
16	0	3.000	.375	.7072	481.0	1.314	.73817	20.71679	.67309
17	0	3.230	.400	.7544	474.6	1.296	.72836	20.44148	.68842
18	0	3.400	.425	.8015	466.6	1.273	.71610	20.09735	.70749
19	0	3.600	.450	.8487	457.1	1.245	.70139	19.68439	.73025
20	0	3.800	.475	.8958	444.3	1.208	.68177	19.13378	.76046
21	0	4.000	.500	.9430	421.9	1.144	.64743	18.17021	.81319
22	180	.200	.025	.0471	595.4	1.642	.91373	25.64381	.36133
23	180	.400	.050	.0943	622.6	1.720	.95538	26.81256	.25621
24	180	.600	.075	.1414	632.1	1.748	.97007	27.22506	.20879
25	180	.800	.100	.1886	638.5	1.766	.97987	27.50006	.17068
26	180	1.000	.125	.2357	640.1	1.771	.98232	27.56881	.15983
27	180	1.200	.150	.2829	641.7	1.775	.98477	27.63756	.14822
28	180	1.400	.175	.3300	643.3	1.780	.98722	27.70631	.13567
30	180	1.830	.225	.4243	641.7	1.775	.98477	27.63756	.14822
31	180	2.000	.250	.4715	641.7	1.775	.98477	27.63756	.14822
32	180	2.200	.275	.5186	640.1	1.771	.98232	27.56881	.15983
33	180	2.430	.300	.5658	638.5	1.766	.97987	27.50006	.17068
34	180	2.600	.325	.6129	636.9	1.761	.97742	27.43131	.18091
35	180	2.800	.350	.6601	632.1	1.748	.97007	27.22506	.20879
36	180	3.030	.375	.7072	627.4	1.734	.96272	27.01881	.23359
37	180	3.200	.400	.7544	622.6	1.720	.95538	26.81256	.25621
38	180	3.400	.425	.8015	614.6	1.697	.94313	26.46881	.29043
39	180	3.600	.450	.8487	601.8	1.661	.92353	25.91881	.33904
40	180	3.800	.475	.8958	585.9	1.615	.89903	25.23131	.39292
41	180	4.000	.500	.9430	553.9	1.523	.85004	23.85631	.48742
42	270	1.030	.125	.2357	560.3	1.541	.85984	24.13131	.46952
43	270	2.030	.250	.4715	553.9	1.523	.85004	23.85631	.48742
44	270	3.030	.375	.7072	534.8	1.468	.82064	23.03130	.53899
45	270	4.000	.500	.9430	462.9	1.262	.71041	19.93755	.71631
46	90	1.000	.125	.2357	549.8	1.511	.84363	23.67633	.49892
47	90	2.030	.250	.4715	541.8	1.488	.83136	23.33220	.52050
48	90	3.000	.375	.7072	522.6	1.433	.80194	22.50628	.57051
49	90	4.030	.500	.9430	450.7	1.227	.69158	19.40909	.74538

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.
Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE IV.- DATA[a] FOR 140° CONE; $M_\infty = 4.63$ - Continued

(e) $\alpha = 20°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 7892.1 psf					Φ = 22.5°, p_t = 7892.1 psf					Φ = 45.0°, p_t = 7882.6 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	463.9	1.282	.72106	20.23641	.69980	468.3	1.277	.71860	20.16758	.70361	471.5	1.288	.72438	20.32969	.69463
2	0	.200	.025	.0471	426.7	1.158	.65584	18.37797	.80182	426.7	1.158	.65484	18.37797	.80182	433.1	1.178	.66545	18.67575	.78553
3	0	.400	.050	.0943	445.9	1.213	.68427	19.20394	.75662	444.3	1.209	.68182	19.13511	.76039	444.3	1.210	.68264	19.15815	.75913
4	0	.600	.075	.1414	458.7	1.250	.70389	19.75459	.72639	453.9	1.236	.69653	19.54810	.73774	452.3	1.233	.69491	19.50272	.74024
5	0	.800	.100	.1886	461.9	1.259	.70879	19.89226	.71881	457.1	1.245	.70144	19.68576	.73018	455.5	1.242	.69983	19.64055	.73267
6	0	1.000	.125	.2357	460.3	1.254	.70634	19.82342	.72260	457.1	1.245	.70144	19.68576	.73018	457.1	1.247	.70228	19.70946	.72888
7	0	1.200	.150	.2829	458.7	1.250	.70389	19.75459	.72639	455.5	1.241	.69898	19.61693	.73396	457.1	1.247	.70228	19.70946	.72888
8	0	1.400	.175	.3300	457.1	1.245	.70144	19.68576	.73018	453.9	1.236	.69653	19.54810	.73774	455.5	1.242	.69983	19.64055	.73267
9	0	1.630	.200	.3772	455.5	1.241	.69898	19.61693	.73396	453.9	1.236	.69653	19.54810	.73774	455.5	1.242	.69983	19.64055	.73267
10	0	1.830	.225	.4243	453.9	1.236	.69653	19.54810	.73774	452.3	1.231	.69408	19.47927	.74152	455.5	1.242	.69983	19.64055	.73267
11	0	2.000	.250	.4715	452.3	1.231	.69408	19.47927	.74152	450.7	1.227	.69163	19.41044	.74530	453.9	1.238	.69737	19.57163	.73645
12	0	2.230	.275	.5186	450.7	1.227	.69163	19.41044	.74530	449.1	1.222	.68917	19.34160	.74908	452.3	1.233	.69491	19.50272	.74024
13	0	2.430	.300	.5558	449.1	1.222	.68917	19.34160	.74908	447.5	1.218	.68672	19.27277	.75285	452.3	1.233	.69491	19.50272	.74024
14	0	2.630	.325	.6129	447.5	1.218	.68672	19.27277	.75285	445.9	1.213	.68427	19.20394	.75662	449.1	1.224	.69000	19.36489	.74780
15	0	2.830	.350	.6601	444.3	1.209	.68182	19.13511	.76039	442.7	1.204	.67936	19.06628	.76416	445.9	1.215	.68509	19.22706	.75535
16	0	3.030	.375	.7072	442.7	1.204	.67936	19.06628	.76416	439.5	1.195	.67446	18.92862	.76790	442.7	1.205	.68018	19.08923	.76290
17	0	3.200	.400	.7544	439.5	1.195	.67446	18.92862	.77170	436.3	1.186	.66955	18.79095	.77923	437.9	1.192	.67281	18.88249	.77422
18	0	3.400	.425	.8015	434.7	1.181	.66710	18.72212	.78299	431.5	1.172	.66219	18.58446	.79052	431.5	1.173	.66299	18.60683	.78930
19	0	3.600	.450	.8487	428.3	1.163	.65729	18.44680	.79805	425.1	1.153	.65238	18.30913	.80558	425.1	1.155	.65317	18.33118	.80438
20	0	3.800	.475	.8958	417.1	1.131	.64012	17.96498	.82442	413.9	1.121	.63522	17.82732	.83197	412.3	1.118	.63353	17.77986	.83457
21	0	4.000	.500	.9430	399.6	1.080	.61314	17.20783	.86602	394.8	1.066	.60579	17.00134	.87741	393.2	1.063	.60406	16.95289	.88009
22	180	.200	.025	.0471	543.8	1.494	.83447	23.41944	.51508	538.0	1.477	.82560	23.17041	.53048	517.8	1.421	.79559	22.32820	.58102
23	180	.400	.050	.0943	588.4	1.622	.90299	25.34245	.38460	577.9	1.592	.88685	24.88929	.41776	548.2	1.509	.84225	23.63757	.50138
24	180	.600	.075	.1414	607.6	1.677	.93236	26.16659	.31790	597.1	1.647	.91624	25.71435	.35572	565.8	1.559	.86926	24.39563	.45192
25	180	.800	.100	.1886	618.7	1.709	.94949	26.64734	.27312	606.7	1.674	.93094	26.12688	.32137	575.4	1.587	.88399	24.80911	.42343
26	180	1.000	.125	.2357	626.7	1.732	.96172	26.99073	.23678	613.0	1.693	.94074	26.40190	.29670	581.8	1.605	.89381	25.08477	.40370
27	180	1.200	.150	.2829	631.5	1.746	.96907	27.19677	.21235	619.4	1.711	.95054	26.67692	.27016	586.5	1.619	.90118	25.29151	.38843
28	180	1.430	.175	.3300	636.3	1.760	.97641	27.40281	.18500	622.6	1.720	.95544	26.81443	.25601	589.7	1.628	.90609	25.42934	.37800
30	180	1.800	.225	.4243	639.5	1.769	.98130	27.54016	.16443	627.4	1.734	.96279	27.02069	.23337	592.9	1.637	.91100	25.56717	.36735
31	180	2.000	.250	.4715	641.1	1.773	.98375	27.60884	.15317	629.0	1.739	.96524	27.08945	.22538	594.5	1.642	.91346	25.63608	.36194
32	180	2.200	.275	.5186	642.7	1.778	.98620	27.67752	.14106	630.6	1.743	.96769	27.15820	.21711	594.5	1.642	.91346	25.63608	.36194
33	180	2.400	.300	.5658	644.3	1.782	.98864	27.74620	.12784	630.6	1.743	.96769	27.15820	.21711	594.5	1.642	.91346	25.63608	.36194
34	180	2.600	.325	.6129	644.3	1.782	.98864	27.74620	.12784	630.6	1.743	.96769	27.15820	.21711	592.9	1.637	.91100	25.56717	.36735
35	180	2.800	.350	.6601	642.7	1.778	.98620	27.67752	.14106	629.0	1.739	.96524	27.08945	.22538	591.3	1.633	.90854	25.49825	.37271
36	180	3.200	.375	.7072	641.1	1.773	.98375	27.60884	.15317	627.4	1.734	.96279	27.02069	.23337	588.1	1.623	.90363	25.36043	.38324
37	180	3.230	.400	.7544	636.3	1.760	.97641	27.40281	.18500	624.2	1.725	.95789	26.88318	.24867	583.4	1.610	.89627	25.15368	.39866
38	180	3.400	.425	.8015	631.5	1.746	.96907	27.19677	.21235	617.8	1.707	.94809	26.60816	.27700	577.0	1.591	.88645	24.87803	.41856
39	180	3.600	.450	.8487	621.9	1.718	.95438	26.78470	.25913	608.2	1.679	.93339	26.19563	.31535	567.4	1.564	.87171	24.46454	.44725
40	180	3.800	.475	.8958	607.6	1.677	.93236	26.16659	.31790	593.9	1.638	.91134	25.57684	.36660	553.0	1.522	.84961	23.84431	.48819
41	180	4.000	.500	.9430	578.9	1.595	.88831	24.93037	.41483	565.1	1.555	.86725	24.33925	.45571	522.6	1.435	.80296	22.53494	.56881
42	270	1.000	.125	.2357	502.3	1.375	.77085	21.63380	.62127	542.8	1.491	.83295	23.37668	.51774	584.9	1.614	.89872	25.22260	.39357
43	270	2.000	.250	.4715	507.1	1.389	.77819	21.83983	.60944	550.8	1.514	.84520	23.72045	.49611	597.7	1.651	.91837	25.77391	.35092
44	270	3.000	.375	.7072	497.5	1.361	.76351	21.42776	.63303	542.8	1.491	.83295	23.37668	.51774	589.7	1.628	.90609	25.42934	.37800
45	270	4.000	.500	.9430	435.3	1.183	.66807	18.74929	.78151	477.3	1.303	.73251	20.55773	.68196	527.4	1.449	.81032	22.74169	.55648
46	90	1.000	.125	.2357	492.3	1.346	.75539	21.20005	.64594	465.1	1.268	.71370	20.02992	.71122	457.1	1.247	.70228	19.70946	.72888
47	90	2.000	.250	.4715	498.6	1.364	.76520	21.47538	.63032	466.7	1.273	.71615	20.09875	.70742	453.9	1.238	.69737	19.57163	.73645
48	90	3.000	.375	.7072	485.9	1.328	.74558	20.92473	.66144	455.5	1.241	.69898	19.61693	.73396	442.7	1.205	.68018	19.08923	.76290
49	90	4.000	.500	.9430	425.1	1.153	.65238	18.30913	.80558	401.2	1.085	.61560	17.27666	.86222	396.4	1.072	.60897	17.09072	.87248

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE IV.- DATA[a] FOR 140° CONE; $M_\infty = 4.63$ - Concluded

(e) $\alpha = 20°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 7882.6 psf					Φ = 90.0°, p_t = 7882.6 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.200	.025	.0471	467.1	1.276	.71766	20.14113	.70507	468.1	1.278	.71922	20.18484	.70265
2	0	.230	.025	.0471	444.7	1.211	.68325	19.17546	.75818	464.9	1.269	.71431	20.04706	.71027
3	0	.400	.050	.0943	449.5	1.225	.69063	19.38239	.74684	472.9	1.292	.72658	20.39151	.69120
4	0	.530	.075	.1414	457.5	1.248	.70292	19.72727	.72790	482.5	1.320	.74131	20.80485	.66816
5	0	.800	.100	.1886	462.3	1.262	.71029	19.93420	.71650	488.9	1.338	.75113	21.08042	.65269
6	0	1.000	.125	.2357	465.5	1.271	.71520	20.07215	.70889	493.7	1.352	.75849	21.28709	.64101
7	0	1.230	.150	.2829	467.1	1.276	.71766	20.14113	.70507	495.3	1.357	.76095	21.35598	.63711
8	0	1.400	.175	.3300	458.7	1.280	.72012	20.21011	.70126	498.5	1.366	.76586	21.49376	.62927
9	0	1.600	.200	.3772	457.1	1.276	.71766	20.14113	.70507	498.5	1.366	.76586	21.49376	.62927
10	0	1.830	.225	.4243	467.1	1.276	.71766	20.14113	.70507	498.5	1.366	.76586	21.49376	.62927
11	0	2.000	.250	.4715	457.1	1.276	.71766	20.14113	.70507	498.5	1.366	.76586	21.49376	.62927
12	0	2.200	.275	.5186	465.5	1.271	.71520	20.07215	.70889	498.5	1.366	.76586	21.49376	.62927
13	0	2.400	.300	.5658	463.9	1.266	.71275	20.00318	.71269	496.9	1.361	.76340	21.42487	.63319
14	0	2.600	.325	.6129	462.3	1.262	.71029	19.93420	.71650	495.3	1.357	.76095	21.35598	.63711
15	0	2.830	.350	.6601	459.1	1.253	.70537	19.79625	.72410	492.1	1.347	.75604	21.21820	.64491
16	0	3.000	.375	.7072	454.3	1.239	.69800	19.58932	.73548	487.3	1.334	.74868	21.01153	.65657
17	0	3.200	.400	.7544	449.5	1.225	.69063	19.38239	.74684	482.5	1.320	.74131	20.80485	.66816
18	0	3.400	.425	.8015	443.1	1.207	.68080	19.10648	.76196	476.1	1.301	.73149	20.52929	.68354
19	0	3.600	.450	.8487	435.1	1.184	.66851	18.76160	.78083	466.5	1.274	.71676	20.11595	.70646
20	0	3.800	.475	.8958	420.7	1.142	.64639	18.14081	.81480	450.5	1.228	.69222	19.42705	.74439
21	0	4.000	.500	.9430	398.3	1.078	.61198	17.17514	.86782	425.0	1.155	.65294	18.32481	.80473
22	180	.200	.025	.0471	498.5	1.366	.76596	21.49675	.62910	474.5	1.297	.72904	20.46040	.68737
23	180	.400	.050	.0943	511.3	1.403	.78560	22.04795	.59739	476.1	1.301	.73149	20.52929	.68354
24	180	.600	.075	.1414	525.7	1.444	.80770	22.66804	.56089	487.3	1.334	.74868	21.01153	.65657
25	180	.800	.100	.1886	533.7	1.467	.81997	23.01254	.54013	492.1	1.347	.75604	21.21820	.64491
26	180	1.000	.125	.2357	540.1	1.485	.82979	23.28814	.52323	495.9	1.361	.76340	21.42487	.63319
27	180	1.200	.150	.2829	543.3	1.494	.83470	23.42594	.51467	500.1	1.370	.76831	21.56265	.62534
28	180	1.400	.175	.3300	546.5	1.504	.83961	23.56374	.50604	503.3	1.379	.77322	21.70043	.61745
30	180	1.800	.225	.4243	548.1	1.508	.84207	23.63264	.50169	503.3	1.379	.77322	21.70043	.61745
31	180	2.000	.250	.4715	549.7	1.513	.84452	23.70154	.49732	504.9	1.384	.77568	21.76932	.61350
32	180	2.200	.275	.5186	548.1	1.508	.84207	23.63264	.50169	503.3	1.379	.77322	21.70043	.61745
33	180	2.400	.300	.5658	548.1	1.508	.84207	23.63264	.50169	501.7	1.375	.77077	21.63154	.62140
34	180	2.600	.325	.6129	546.5	1.504	.83961	23.56374	.50604	500.1	1.370	.76831	21.56265	.62534
35	180	2.830	.350	.6601	541.7	1.490	.83225	23.35704	.51896	496.9	1.361	.76340	21.42487	.63319
36	180	3.000	.375	.7072	538.5	1.481	.82734	23.21924	.52748	492.1	1.347	.75604	21.21820	.64491
37	180	3.200	.400	.7544	533.7	1.467	.81997	23.01254	.54013	487.3	1.334	.74868	21.01153	.65657
38	180	3.400	.425	.8015	525.7	1.444	.80770	22.66804	.56089	479.3	1.311	.73640	20.66707	.67586
39	180	3.600	.450	.8487	516.1	1.416	.79297	22.25464	.58533	469.7	1.283	.72167	20.25373	.69884
40	180	3.830	.475	.8958	500.1	1.371	.76842	21.56565	.62517	455.3	1.242	.69958	19.63372	.73304
41	180	4.000	.500	.9430	471.4	1.288	.72423	20.32545	.69487	429.8	1.168	.66031	18.53148	.79342
42	270	1.300	.125	.2357	615.2	1.701	.94518	26.52643	.28495	626.3	1.733	.96223	27.00498	.23517
43	270	2.300	.250	.4715	631.2	1.747	.96973	27.21543	.21001	642.3	1.779	.98678	27.69388	.13802
44	270	3.000	.375	.7072	629.6	1.742	.96728	27.14653	.21854	640.7	1.774	.98432	27.62499	.15041
45	270	4.000	.500	.9430	570.4	1.573	.87644	24.59724	.43818	581.6	1.604	.89350	25.07605	.40433
46	90	1.000	.125	.2357	457.5	1.248	.70292	19.72727	.72790	460.1	1.256	.70695	19.84039	.72167
47	90	2.300	.250	.4715	451.1	1.230	.69308	19.45136	.74306	452.1	1.233	.69467	19.49594	.74061
48	90	3.000	.375	.7072	439.9	1.197	.67588	18.96853	.76951	442.6	1.205	.67994	19.08260	.76327
49	90	4.000	.500	.9430	396.7	1.073	.60952	17.10616	.87162	402.6	1.090	.61858	17.36034	.85762

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Data for orifice 29 were inaccurate due to leakage and are not presented.

TABLE V.- DATA[a] FOR 160° CONE; $M_\infty = 2.30$

(a) $\alpha = 0°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 2291.4 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.030	.000	.0000	1334.8	1.697	.99867	7.28404	.04363
2	0	.230	.025	.0493	1334.8	1.697	.99867	7.28404	.04363
3	0	.430	.050	.0985	1333.2	1.695	.99747	7.27531	.06014
4	0	.630	.075	.1478	1330.0	1.690	.99508	7.25787	.08397
5	0	.830	.100	.1971	1325.2	1.683	.99149	7.23170	.11055
6	0	1.030	.125	.2463	1320.4	1.676	.98790	7.20553	.13197
7	0	1.230	.150	.2956	1315.6	1.669	.98432	7.17936	.15045
8	0	1.430	.175	.3448	1309.2	1.659	.97953	7.14446	.17213
9	0	1.630	.200	.3941	1302.8	1.650	.97475	7.10957	.19150
10	0	1.830	.225	.4434	1294.8	1.638	.96877	7.06595	.21339
11	0	2.030	.250	.4926	1288.4	1.629	.96398	7.03106	.22951
12	0	2.230	.275	.5419	1278.8	1.615	.95681	6.97872	.25194
13	0	2.430	.300	.5912	1266.1	1.596	.94724	6.90893	.27935
14	0	2.630	.325	.6404	1251.7	1.575	.93648	6.83042	.30764
15	0	2.830	.350	.6897	1237.3	1.553	.92571	6.75191	.33392
16	0	3.030	.375	.7389	1221.3	1.530	.91375	6.66468	.36128
17	0	3.230	.400	.7882	1195.7	1.492	.89462	6.52510	.40205
18	0	3.430	.425	.8375	1168.5	1.452	.87428	6.37680	.44234
19	0	3.630	.450	.8867	1131.8	1.398	.84678	6.17616	.49329
20	0	3.830	.475	.9360	1059.8	1.292	.79295	5.78361	.58536
21	0	4.030	.500	.9852	967.1	1.155	.72159	5.27765	.69587
22	180	.200	.025	.0493	1336.6	1.700	.99995	7.29338	.00850
23	180	.430	.050	.0985	1334.9	1.697	.99875	7.28467	.04219
24	180	.630	.075	.1478	1330.1	1.690	.99517	7.25852	.08319
25	180	.830	.100	.1971	1326.9	1.685	.99278	7.24110	.10179
26	180	1.000	.125	.2463	1322.1	1.678	.98920	7.21496	.12466
27	180	1.200	.150	.2956	1318.9	1.674	.98681	7.19753	.13787
28	180	1.430	.175	.3448	1311.0	1.662	.98083	7.15396	.16650
29	180	1.600	.200	.3941	1304.6	1.652	.97606	7.11910	.18639
30	180	1.800	.225	.4434	1296.6	1.641	.97008	7.07554	.20876
31	180	2.000	.250	.4926	1290.2	1.631	.96530	7.04068	.22517
32	180	2.230	.275	.5419	1279.0	1.615	.95694	6.97969	.25154
33	180	2.400	.300	.5912	1269.4	1.601	.94977	6.92740	.27233
34	180	2.600	.325	.6404	1255.1	1.580	.93902	6.84898	.30116
35	180	2.800	.350	.6897	1239.1	1.556	.92707	6.76184	.33069
36	180	3.000	.375	.7389	1221.5	1.530	.91393	6.66599	.36088
37	180	3.200	.400	.7882	1197.6	1.495	.89601	6.53529	.39918
38	180	3.400	.425	.8375	1170.4	1.455	.87570	6.38715	.43961
39	180	3.600	.450	.8867	1127.3	1.391	.84345	6.15188	.49924
40	180	3.800	.475	.9360	1063.5	1.297	.79566	5.80333	.58090
41	180	4.000	.500	.9852	948.5	1.128	.70964	5.17595	.71750
42	270	1.000	.125	.2463	1318.9	1.674	.98681	7.19753	.13787
43	270	2.000	.250	.4926	1285.4	1.624	.96172	7.01454	.23680
44	270	3.000	.375	.7389	1219.9	1.528	.91274	6.65728	.36353
45	270	4.000	.500	.9852	942.1	1.118	.70486	5.14109	.72489
46	90	1.000	.125	.2463	1323.6	1.681	.99030	7.22297	.11811
47	90	2.000	.250	.4926	1290.0	1.631	.96518	7.03978	.22558
48	90	3.000	.375	.7389	1221.3	1.530	.91375	6.66468	.36128
49	90	4.000	.500	.9852	935.8	1.110	.70086	5.11191	.73107

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE V.- DATA[a] FOR 160° CONE; M_∞ = 2.30 - Continued

(b) α = 5°

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 2294.6 psf					Φ = 22.5°, p_t = 2291.2 psf					Φ = 45.0°, p_t = 2291.9 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1330.0	1.687	.99369	7.24774	.09512	1328.3	1.688	.99390	7.24927	.09352	1326.7	1.685	.99240	7.23834	.10443
2	0	.230	.025	.0493	1321.6	1.678	.98892	7.21290	.12629	1320.3	1.676	.98792	7.20565	.13187	1321.9	1.678	.98882	7.21217	.12686
3	0	.400	.050	.0985	1318.8	1.671	.98533	7.18677	.14544	1318.7	1.673	.98673	7.19693	.13830	1317.1	1.671	.98523	7.18601	.14596
4	0	.530	.075	.1478	1314.0	1.664	.98175	7.16063	.16243	1312.3	1.664	.98196	7.16204	.16156	1313.9	1.666	.98284	7.16857	.15745
5	0	.800	.100	.1971	1307.6	1.654	.97697	7.12579	.18274	1307.5	1.657	.97835	7.13587	.17709	1310.7	1.661	.98045	7.15113	.16820
6	0	1.000	.125	.2463	1301.2	1.645	.97219	7.09094	.20112	1299.5	1.645	.97237	7.09225	.20046	1302.7	1.649	.97647	7.10752	.19257
7	0	1.200	.150	.2956	1293.2	1.633	.96622	7.04739	.22210	1291.5	1.633	.96639	7.04863	.22153	1294.7	1.638	.96849	7.06392	.21435
8	0	1.430	.175	.3448	1286.8	1.624	.96145	7.01254	.23766	1283.6	1.622	.96041	7.00501	.24091	1288.3	1.628	.96371	7.02904	.23042
9	0	1.630	.200	.3941	1277.2	1.610	.95428	6.96027	.25943	1277.2	1.612	.95563	6.97012	.25546	1280.4	1.616	.95773	6.98543	.24917
10	0	1.830	.225	.4434	1267.7	1.595	.94711	6.90801	.27969	1266.0	1.596	.94726	6.90905	.27930	1270.8	1.602	.95055	6.93311	.27013
11	0	2.030	.250	.4926	1258.1	1.581	.93995	6.85574	.29877	1254.8	1.579	.93888	6.84799	.30151	1261.2	1.588	.94338	6.88078	.28976
12	0	2.230	.275	.5419	1245.3	1.563	.93039	6.78605	.32271	1243.6	1.563	.93051	6.78692	.32241	1250.0	1.572	.93501	6.81973	.31133
13	0	2.430	.300	.5912	1230.9	1.541	.91964	6.70765	.34801	1230.8	1.544	.92094	6.71713	.34503	1237.2	1.553	.92545	6.74997	.33454
14	0	2.630	.325	.6404	1215.5	1.520	.90889	6.62925	.37195	1218.0	1.525	.91138	6.64735	.36653	1222.8	1.532	.91468	6.67148	.35921
15	0	2.800	.350	.6897	1200.5	1.497	.89695	6.54213	.39724	1198.8	1.497	.89702	6.54266	.39709	1206.8	1.508	.90273	6.58427	.38516
16	0	3.030	.375	.7389	1181.3	1.468	.88262	6.43760	.42614	1181.3	1.471	.88387	6.44670	.42368	1187.6	1.480	.88838	6.47962	.41469
17	0	3.230	.400	.7882	1154.2	1.428	.86232	6.28951	.46493	1154.1	1.431	.86353	6.29840	.46266	1162.1	1.442	.86925	6.34009	.45193
18	0	3.430	.425	.8375	1127.0	1.388	.84201	6.14142	.50179	1128.5	1.393	.84440	6.15883	.49754	1134.9	1.402	.84892	6.19183	.48943
19	0	3.630	.450	.8867	1090.2	1.334	.81454	5.94106	.54936	1090.1	1.337	.81569	5.94946	.54741	1096.5	1.346	.82023	5.98259	.53970
20	0	3.830	.475	.9360	1023.1	1.236	.76438	5.57519	.63164	1021.4	1.235	.76426	5.57435	.63182	1025.2	1.242	.76762	5.59881	.62645
21	0	4.000	.500	.9852	932.0	1.101	.69630	5.07865	.73810	931.9	1.103	.69729	5.08583	.73658	938.3	1.112	.70186	5.11916	.72953
22	180	.230	.025	.0493	1334.9	1.694	.99736	7.27451	.06144	1333.2	1.695	.99758	7.27608	.05887	1331.6	1.692	.99608	7.26515	.07494
23	180	.430	.050	.0985	1336.5	1.697	.99855	7.28321	.04546	1334.8	1.697	.99877	7.28480	.04189	1331.6	1.692	.99608	7.26515	.07494
24	180	.630	.075	.1478	1336.5	1.697	.99855	7.28321	.04546	1334.8	1.697	.99877	7.28480	.04189	1330.0	1.690	.99488	7.25644	.08563
25	180	.830	.100	.1971	1334.9	1.694	.99736	7.27451	.06144	1334.8	1.697	.99877	7.28480	.04189	1330.0	1.690	.99488	7.25644	.08563
26	180	1.030	.125	.2463	1334.9	1.694	.99736	7.27451	.06144	1331.6	1.693	.99638	7.26737	.07107	1326.8	1.685	.99250	7.23901	.10379
27	180	1.230	.150	.2956	1331.7	1.690	.99498	7.25710	.08486	1326.8	1.685	.99280	7.24123	.10166	1322.0	1.678	.98891	7.21288	.12630
28	180	1.400	.175	.3448	1330.1	1.687	.99378	7.24840	.09443	1325.2	1.683	.99160	7.23251	.10981	1318.8	1.673	.98652	7.19566	.13936
29	180	1.630	.200	.3941	1325.3	1.680	.99020	7.22230	.11867	1320.4	1.676	.98802	7.20637	.13133	1314.1	1.666	.98294	7.16932	.15697
30	180	1.830	.225	.4434	1320.5	1.673	.98662	7.19619	.13883	1317.3	1.671	.98563	7.18894	.14394	1309.3	1.659	.97936	7.14319	.17288
31	180	2.030	.250	.4926	1315.7	1.666	.98305	7.17009	.15649	1309.3	1.660	.97966	7.14537	.17160	1302.9	1.650	.97458	7.10835	.19214
32	180	2.230	.275	.5419	1307.8	1.654	.97708	7.12658	.18230	1302.9	1.650	.97488	7.11052	.19099	1294.9	1.638	.96861	7.06479	.21394
33	180	2.430	.300	.5912	1298.2	1.640	.95992	7.07437	.20933	1294.9	1.638	.96890	7.06695	.21291	1285.3	1.624	.96144	7.01252	.23767
34	180	2.630	.325	.6404	1287.0	1.624	.96157	7.01346	.23727	1283.7	1.622	.96054	7.00595	.24051	1274.1	1.607	.95308	6.95154	.26291
35	180	2.800	.350	.6897	1274.2	1.605	.95203	6.94385	.26594	1269.4	1.601	.94979	6.92753	.27228	1261.4	1.588	.94353	6.88185	.28937
36	180	3.030	.375	.7389	1258.3	1.582	.94010	6.85683	.29838	1253.4	1.577	.93784	6.84039	.30417	1243.8	1.563	.93039	6.78603	.32271
37	180	3.200	.400	.7882	1237.5	1.551	.92459	6.74371	.33656	1231.0	1.544	.92112	6.71839	.34463	1221.5	1.530	.91367	6.66407	.36147
38	180	3.400	.425	.8375	1210.4	1.511	.90431	6.59578	.38181	1205.5	1.507	.90200	6.57897	.38870	1195.9	1.492	.89456	6.52469	.40217
39	180	3.630	.450	.8867	1170.4	1.452	.87448	6.37825	.44196	1155.6	1.448	.87213	6.36112	.44665	1154.4	1.431	.86351	6.29820	.46271
40	180	3.800	.475	.9360	1108.2	1.361	.82795	6.03888	.52642	1101.7	1.354	.82435	6.01257	.53264	1070.5	1.337	.81573	5.94976	.54734
41	180	4.000	.500	.9852	988.4	1.185	.73848	5.38627	.67261	983.5	1.180	.73594	5.36774	.67659	974.0	1.165	.72855	5.31384	.68814
42	270	1.030	.125	.2463	1315.7	1.666	.98305	7.17009	.15649	1318.8	1.674	.98683	7.19766	.13777	1325.2	1.683	.99130	7.23030	.11179
43	270	2.030	.250	.4926	1283.8	1.619	.95919	6.99606	.24472	1290.1	1.631	.96532	7.04081	.22511	1301.3	1.647	.97339	7.09963	.19668
44	270	3.030	.375	.7389	1215.2	1.518	.90789	6.62189	.37413	1229.4	1.542	.91992	6.70968	.34738	1243.8	1.563	.93039	6.78603	.32271
45	270	4.000	.500	.9852	938.9	1.112	.70149	5.11652	.73009	953.2	1.135	.71324	5.20218	.71193	969.2	1.158	.72496	5.28770	.69372
46	90	1.030	.125	.2463	1317.2	1.668	.98414	7.17805	.15131	1307.5	1.657	.97835	7.13587	.17709	1301.1	1.647	.97327	7.09880	.19711
47	90	2.030	.250	.4926	1285.2	1.621	.96025	7.00383	.24141	1270.8	1.603	.95086	6.93522	.26931	1261.2	1.588	.94338	6.88078	.28976
48	90	3.030	.375	.7389	1214.9	1.518	.90770	6.62054	.37453	1230.4	1.499	.89822	6.55139	.39461	1187.6	1.480	.88838	6.47962	.41469
49	90	4.000	.500	.9852	932.0	1.101	.69630	5.07865	.73810	917.5	1.082	.68652	5.00732	.75316	906.3	1.065	.67794	4.94474	.76634

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE V.- DATA[a] FOR 160° CONE; $M_\infty = 2.30$ - Continued

(b) $\alpha = 5°$ - Concluded

Orifice	e, deg	s, in.	s/D	s/s*	$\Phi = 67.5°$, $p_t = 2293.3$ psf					$\Phi = 90.0°$, $p_t = 2295.8$ psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1328.2	1.686	.99292	7.24213	.10078	1329.8	1.686	.99304	7.24295	.09997
2	0	.200	.025	.0493	1325.0	1.681	.99053	7.22470	.11665	1328.2	1.684	.99184	7.23424	.10824
3	0	.400	.050	.0985	1323.4	1.679	.98934	7.21598	.12384	1326.6	1.681	.99065	7.22554	.11593
4	0	.600	.075	.1478	1318.6	1.672	.98575	7.18984	.14332	1323.4	1.677	.98826	7.20813	.12999
5	0	.800	.100	.1971	1315.4	1.667	.98336	7.17241	.15499	1320.2	1.672	.98587	7.19072	.14271
6	0	1.000	.125	.2463	1310.6	1.660	.97978	7.14627	.17108	1317.0	1.667	.98349	7.17331	.15441
7	0	1.200	.150	.2956	1302.6	1.648	.97381	7.10269	.19510	1313.6	1.658	.97871	7.13848	.17559
8	0	1.400	.175	.3448	1297.8	1.641	.97022	7.07655	.20827	1304.2	1.648	.97394	7.10366	.19460
9	0	1.600	.200	.3941	1289.9	1.629	.96425	7.03297	.22866	1297.8	1.639	.96916	7.06884	.21200
10	0	1.800	.225	.4434	1280.3	1.615	.95708	6.98068	.25113	1291.5	1.629	.96439	7.03402	.22819
11	0	2.000	.250	.4926	1270.7	1.601	.94991	6.92839	.27195	1283.5	1.618	.95842	6.99049	.24706
12	0	2.200	.275	.5419	1261.1	1.587	.94274	6.87610	.29146	1270.7	1.599	.94887	6.92085	.27486
13	0	2.400	.300	.5912	1248.3	1.568	.93318	6.80638	.31588	1261.1	1.585	.94171	6.86861	.29417
14	0	2.600	.325	.6404	1235.5	1.549	.92362	6.73666	.33883	1248.3	1.566	.93216	6.79897	.31838
15	0	2.800	.350	.6897	1217.9	1.523	.91048	6.64090	.36850	1230.7	1.540	.91904	6.70321	.34940
16	0	3.000	.375	.7389	1201.9	1.500	.89853	6.55365	.39397	1214.7	1.517	.90710	6.61616	.37583
17	0	3.200	.400	.7882	1174.8	1.460	.87822	6.40549	.43474	1189.2	1.479	.88800	6.47687	.41545
18	0	3.400	.425	.8375	1147.6	1.420	.85790	6.25734	.47309	1162.0	1.439	.86771	6.32887	.45483
19	0	3.600	.450	.8867	1109.2	1.363	.82923	6.04818	.52421	1125.2	1.385	.84026	6.12865	.50489
20	0	3.800	.475	.9360	1040.5	1.262	.77785	5.67344	.60999	1056.5	1.284	.78894	5.75431	.59195
21	0	4.000	.500	.9852	951.0	1.130	.71094	5.18540	.71549	963.8	1.148	.71971	5.24940	.70189
22	180	.200	.025	.0493	1331.5	1.691	.99540	7.26021	.08117	1329.9	1.686	.99313	7.24361	.09932
23	180	.400	.050	.0985	1329.9	1.688	.99421	7.25150	.09113	1326.7	1.681	.99074	7.22621	.11535
24	180	.600	.075	.1478	1328.3	1.686	.99301	7.24280	.10012	1323.5	1.677	.98836	7.20882	.12946
25	180	.800	.100	.1971	1325.1	1.681	.99063	7.22539	.11606	1320.4	1.672	.98597	7.19143	.14221
26	180	1.000	.125	.2463	1323.5	1.679	.98943	7.21668	.12328	1317.2	1.667	.98359	7.17404	.15394
27	180	1.200	.150	.2956	1314.8	1.672	.98585	7.19057	.14281	1310.8	1.658	.97882	7.13926	.17515
28	180	1.400	.175	.3448	1314.0	1.665	.98227	7.16445	.16005	1302.8	1.646	.97286	7.09578	.19866
29	180	1.600	.200	.3941	1307.6	1.655	.97750	7.12963	.18060	1298.0	1.639	.96928	7.06969	.21159
30	180	1.800	.225	.4434	1301.2	1.646	.97272	7.09481	.19916	1291.6	1.630	.96451	7.03491	.22779
31	180	2.000	.250	.4926	1293.2	1.634	.96676	7.05128	.22030	1283.6	1.618	.95855	6.99143	.24666
32	180	2.200	.275	.5419	1283.6	1.620	.95960	6.99905	.24345	1272.5	1.602	.95021	6.93056	.27111
33	180	2.400	.300	.5912	1274.1	1.606	.95243	6.94682	.26478	1261.3	1.585	.94186	6.86949	.29378
34	180	2.600	.325	.6404	1262.9	1.589	.94408	6.88588	.28790	1248.5	1.566	.93232	6.80012	.31799
35	180	2.800	.350	.6897	1246.9	1.566	.93214	6.79883	.31843	1232.5	1.543	.92040	6.71316	.34628
36	180	3.000	.375	.7389	1230.9	1.542	.92021	6.71177	.34672	1215.0	1.517	.90728	6.61751	.37543
37	180	3.200	.400	.7882	1207.0	1.507	.90231	6.58120	.38605	1191.0	1.482	.88940	6.48707	.41264
38	180	3.400	.425	.8375	1181.5	1.470	.88321	6.44191	.42497	1165.5	1.444	.87033	6.34794	.44989
39	180	3.600	.450	.8867	1139.9	1.408	.85218	6.21557	.48355	1122.4	1.381	.83814	6.11315	.50865
40	180	3.800	.475	.9360	1076.1	1.314	.80444	5.86736	.56634	1060.1	1.289	.79164	5.77401	.58752
41	180	4.000	.500	.9852	959.5	1.143	.71731	5.23188	.70562	943.6	1.118	.70461	5.13922	.72528
42	270	1.000	.125	.2463	1331.5	1.691	.99540	7.26021	.08117	1333.1	1.691	.99551	7.26100	.08021
43	270	2.000	.250	.4926	1309.2	1.658	.97869	7.13833	.17568	1314.0	1.663	.98120	7.15665	.16487
44	270	3.000	.375	.7389	1253.3	1.575	.93692	6.83365	.30652	1255.5	1.578	.93828	6.84360	.30305
45	270	4.000	.500	.9852	980.3	1.173	.73283	5.34505	.68145	983.5	1.177	.73441	5.35662	.67898
46	90	1.000	.125	.2463	1301.0	1.646	.97261	7.09398	.19958	1301.0	1.644	.97155	7.08625	.20347
47	90	2.000	.250	.4926	1257.9	1.582	.94035	6.85867	.29772	1256.3	1.578	.93813	6.84250	.30344
48	90	3.000	.375	.7389	1182.8	1.472	.88419	6.44907	.42304	1181.2	1.467	.88203	6.43334	.42729
49	90	4.000	.500	.9852	901.5	1.057	.67390	4.91524	.77256	899.9	1.054	.67197	4.90118	.77552

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE V.- DATA[a] FOR 160° CONE; $M_\infty = 2.30$ - Continued

(c) $\alpha = 10°$

Orifice	θ, deg	s, in.	s/D	s/s*	$\Phi = 0.0°$, $p_t = 2290.8$ psf					$\Phi = 22.5°$, $p_t = 2291.4$ psf					$\Phi = 45.0°$, $p_t = 2293.8$ psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1304.4	1.653	.97620	7.12016	.18582	1304.2	1.652	.97576	7.11698	.18754	1304.3	1.650	.97486	7.11035	.19108
2	0	.250	.025	.0493	1293.2	1.636	.96783	7.05908	.21665	1294.6	1.638	.96858	7.06459	.21404	1297.9	1.641	.97008	7.07549	.20878
3	0	.500	.050	.0985	1288.4	1.629	.96424	7.03290	.22869	1291.4	1.633	.96619	7.04712	.22222	1293.1	1.634	.96649	7.04935	.22119
4	0	.750	.075	.1478	1282.0	1.620	.95945	6.99800	.24390	1283.4	1.621	.96020	7.00346	.24157	1288.3	1.627	.96291	7.02321	.23300
5	0	.800	.100	.1971	1276.0	1.608	.95347	6.95437	.26179	1277.0	1.612	.95541	6.96853	.25610	1283.6	1.620	.95932	6.99707	.24429
6	0	1.000	.125	.2463	1266.1	1.596	.94749	6.91074	.27867	1269.0	1.600	.94943	6.92487	.27330	1274.0	1.605	.95216	6.94479	.26557
7	0	1.200	.150	.2956	1258.1	1.584	.94151	6.86711	.29471	1259.4	1.586	.94224	6.87247	.29278	1267.6	1.596	.94738	6.90994	.27897
8	0	1.400	.175	.3448	1248.5	1.570	.93433	6.81476	.31303	1249.8	1.572	.93506	6.82008	.31121	1259.6	1.584	.94140	6.86637	.29497
9	0	1.600	.200	.3941	1238.9	1.556	.92715	6.76240	.33050	1240.2	1.558	.92787	6.76768	.32878	1250.0	1.570	.93424	6.81409	.31326
10	0	1.800	.225	.4434	1227.7	1.540	.91878	6.70132	.34999	1230.6	1.543	.92069	6.71529	.34561	1238.8	1.554	.92587	6.75309	.33353
11	0	2.000	.250	.4926	1214.9	1.521	.90921	6.63152	.37127	1217.8	1.525	.91111	6.64543	.36711	1227.6	1.537	.91751	6.69209	.35286
12	0	2.200	.275	.5419	1203.7	1.504	.90083	6.57044	.38916	1206.6	1.508	.90273	6.58430	.38515	1216.4	1.521	.90915	6.63110	.37140
13	0	2.400	.300	.5912	1187.7	1.481	.88887	6.48318	.41371	1190.6	1.484	.89076	6.49697	.40990	1203.6	1.502	.89959	6.56139	.39176
14	0	2.600	.325	.6404	1173.3	1.460	.87810	6.40465	.43497	1176.2	1.463	.87998	6.41838	.43130	1187.6	1.478	.88764	6.47425	.41617
15	0	2.800	.350	.6897	1155.8	1.434	.86494	6.30867	.46003	1158.6	1.437	.86681	6.32233	.45652	1170.1	1.452	.87450	6.37840	.44191
16	0	3.000	.375	.7389	1138.2	1.408	.85178	6.21269	.48426	1141.0	1.411	.85364	6.22627	.48088	1152.5	1.427	.86136	6.28255	.46670
17	0	3.200	.400	.7882	1109.4	1.365	.83025	6.05562	.52244	1113.8	1.371	.83329	6.07782	.51715	1125.3	1.387	.84105	6.13442	.50349
18	0	3.400	.425	.8375	1083.8	1.328	.81111	5.91601	.55516	1086.6	1.331	.81294	5.92936	.55207	1098.1	1.347	.82074	5.98629	.53882
19	0	3.600	.450	.8867	1047.1	1.273	.78359	5.71532	.60067	1048.1	1.275	.78420	5.71978	.59968	1061.4	1.292	.79326	5.78587	.58485
20	0	3.800	.475	.9360	979.9	1.174	.73335	5.34884	.68064	982.5	1.178	.73512	5.36175	.67788	994.2	1.194	.74309	5.41990	.66537
21	0	4.000	.500	.9852	896.8	1.052	.67114	4.89511	.77680	897.7	1.053	.67166	4.89893	.77599	909.5	1.069	.67977	4.95807	.76353
22	180	.250	.025	.0493	1318.9	1.674	.98707	7.19941	.13650	1318.8	1.674	.98674	7.19703	.13823	1315.7	1.667	.98332	7.17209	.15520
23	180	.500	.050	.0985	1326.9	1.686	.99304	7.24299	.09993	1326.8	1.685	.99271	7.24059	.10227	1320.4	1.674	.98690	7.19820	.13738
24	180	.600	.075	.1478	1331.7	1.693	.99663	7.26914	.06950	1331.6	1.692	.99630	7.26673	.07283	1325.2	1.681	.99048	7.22431	.11698
25	180	.800	.100	.1971	1334.9	1.698	.99902	7.28657	.03750	1333.2	1.695	.99749	7.27545	.05992	1325.2	1.681	.99048	7.22431	.11698
26	180	1.000	.125	.2463	1338.1	1.702	1.00141	7.30401	.00000	1334.8	1.697	.99869	7.28416	.04336	1325.2	1.681	.99048	7.22431	.11698
27	180	1.200	.150	.2956	1339.7	1.705	1.00260	7.31272	.00000	1334.8	1.697	.99869	7.28416	.04336	1325.2	1.681	.99048	7.22431	.11698
28	180	1.400	.175	.3448	1338.1	1.702	1.00141	7.30401	.00000	1333.2	1.695	.99749	7.27545	.05992	1322.0	1.676	.98809	7.20691	.13092
29	180	1.600	.200	.3941	1338.1	1.702	1.00141	7.30401	.00000	1333.2	1.695	.99749	7.27545	.05992	1318.8	1.671	.98571	7.18950	.14356
30	180	1.800	.225	.4434	1336.5	1.700	1.00021	7.29529	.00000	1330.0	1.690	.99510	7.25802	.08379	1315.7	1.667	.98332	7.17209	.15520
31	180	2.000	.250	.4926	1331.7	1.693	.99663	7.26914	.06950	1325.2	1.683	.99152	7.23188	.11038	1310.9	1.660	.97974	7.14598	.17125
32	180	2.200	.275	.5419	1328.5	1.688	.99424	7.25171	.09091	1322.0	1.678	.98913	7.21445	.12506	1304.5	1.650	.97497	7.11116	.19065
33	180	2.400	.300	.5912	1322.1	1.679	.98946	7.21685	.12315	1314.1	1.666	.98316	7.17099	.15597	1296.5	1.639	.96900	7.06764	.21258
34	180	2.600	.325	.6404	1314.2	1.667	.98348	7.17327	.15644	1306.1	1.655	.97718	7.12732	.18189	1296.9	1.624	.96184	7.01542	.23641
35	180	2.800	.350	.6897	1304.6	1.653	.97631	7.12097	.18538	1294.9	1.638	.96882	7.06633	.21321	1275.7	1.608	.95349	6.95449	.26174
36	180	3.000	.375	.7389	1290.2	1.632	.96556	7.04253	.22433	1282.1	1.619	.95926	6.99663	.24447	1261.4	1.587	.94275	6.87615	.29144
37	180	3.200	.400	.7882	1272.6	1.606	.95241	6.94665	.26484	1263.0	1.591	.94493	6.89207	.28562	1242.2	1.559	.92843	6.77171	.32745
38	180	3.400	.425	.8375	1248.7	1.571	.93449	6.81591	.31263	1239.0	1.556	.92701	6.76137	.33084	1218.3	1.523	.91053	6.64115	.36839
39	180	3.600	.450	.8867	1212.0	1.516	.90700	6.61544	.37604	1202.3	1.502	.89953	6.56097	.39188	1178.3	1.465	.88069	6.42355	.42992
40	180	3.800	.475	.9360	1149.7	1.425	.86040	6.27552	.46849	1138.4	1.408	.85175	6.21245	.48432	1114.5	1.371	.83296	6.07539	.51773
41	180	4.000	.500	.9852	1031.5	1.250	.77197	5.63053	.61947	1021.9	1.236	.76454	5.57639	.63137	999.5	1.201	.74704	5.44870	.65915
42	270	1.000	.125	.2463	1296.6	1.641	.97034	7.07739	.20785	1310.9	1.662	.98077	7.15346	.16680	1325.2	1.681	.99048	7.22431	.11698
43	270	2.000	.250	.4926	1266.2	1.596	.94763	6.91179	.27827	1288.5	1.629	.96404	7.03148	.22932	1310.9	1.660	.97974	7.14598	.17125
44	270	3.000	.375	.7389	1199.2	1.498	.89744	6.54571	.39623	1231.0	1.544	.92104	6.71781	.34482	1261.4	1.587	.94275	6.87615	.29144
45	270	4.000	.500	.9852	927.7	1.097	.69429	5.06399	.74119	962.8	1.149	.72034	5.25400	.70091	996.3	1.197	.74665	5.43129	.66291
46	90	1.000	.125	.2463	1298.0	1.643	.97141	7.08525	.20397	1283.4	1.621	.96020	7.00346	.24157	1275.6	1.608	.95335	6.95350	.26213
47	90	2.000	.250	.4926	1267.7	1.599	.94858	6.91947	.27536	1245.0	1.565	.93147	6.79388	.32009	1230.8	1.542	.91990	6.70952	.34743
48	90	3.000	.375	.7389	1202.1	1.502	.89964	6.56171	.39166	1171.4	1.456	.87639	6.39218	.43828	1154.1	1.429	.86256	6.29127	.46449
49	90	4.000	.500	.9852	922.4	1.090	.69028	5.03472	.74738	894.5	1.048	.66927	4.88146	.77967	877.5	1.022	.65588	4.78380	.80022

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE V.- DATA[a] FOR 160° CONE; M_∞ = 2.30 - Continued

(c) α = 10° - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 2294.8 psf					Φ = 90.0°, p_t = 2295.1 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1304.3	1.649	.97443	7.10725	.19272	1305.8	1.651	.97543	7.11454	.18885
2	0	.200	.025	.0493	1301.1	1.645	.97204	7.08983	.20168	1304.2	1.649	.97424	7.10583	.19346
3	0	.400	.050	.0985	1297.9	1.640	.96965	7.07241	.21028	1304.2	1.649	.97424	7.10583	.19346
4	0	.600	.075	.1478	1294.7	1.635	.96727	7.05499	.21857	1304.2	1.649	.97424	7.10583	.19346
5	0	.800	.100	.1971	1291.5	1.630	.96488	7.03757	.22658	1301.0	1.644	.97185	7.08841	.20239
6	0	1.000	.125	.2463	1283.6	1.619	.95891	6.99402	.24557	1297.8	1.639	.96946	7.07100	.21096
7	0	1.200	.150	.2956	1275.6	1.607	.95294	6.95047	.26333	1293.1	1.632	.96588	7.04487	.22326
8	0	1.400	.175	.3448	1270.8	1.600	.94935	6.92434	.27350	1289.9	1.628	.96349	7.02746	.23112
9	0	1.600	.200	.3941	1262.8	1.588	.94338	6.88079	.28976	1283.5	1.618	.95871	6.99262	.24616
10	0	1.800	.225	.4434	1254.8	1.576	.93741	6.83725	.30527	1275.5	1.607	.95274	6.94908	.26388
11	0	2.000	.250	.4926	1245.2	1.562	.93025	6.78499	.32306	1265.9	1.592	.94558	6.89683	.28386
12	0	2.200	.275	.5419	1235.6	1.548	.92308	6.73273	.34008	1256.3	1.578	.93842	6.84458	.30270
13	0	2.400	.300	.5912	1222.8	1.529	.91353	6.66305	.36178	1245.1	1.562	.93006	6.78363	.32351
14	0	2.600	.325	.6404	1206.8	1.506	.90159	6.57595	.38757	1232.3	1.543	.92051	6.71396	.34603
15	0	2.800	.350	.5897	1190.8	1.482	.88965	6.48885	.41215	1217.9	1.522	.90976	6.63559	.37006
16	0	3.000	.375	.7389	1173.3	1.456	.87651	6.39304	.43805	1200.3	1.496	.89663	6.53980	.39790
17	0	3.200	.400	.7882	1147.7	1.419	.85740	6.25368	.47401	1176.4	1.461	.87872	6.40918	.43376
18	0	3.400	.425	.8375	1123.5	1.379	.83710	6.10562	.51047	1149.2	1.421	.85843	6.26114	.47213
19	0	3.600	.450	.8867	1082.1	1.322	.80844	5.89658	.55964	1112.4	1.367	.83097	6.06085	.52120
20	0	3.800	.475	.9360	1016.6	1.226	.75948	5.53948	.63944	1045.3	1.268	.78082	5.69511	.60517
21	0	4.000	.500	.9852	927.1	1.094	.69261	5.05172	.74379	954.2	1.134	.71277	5.19875	.71266
22	180	.200	.025	.0493	1312.5	1.661	.98051	7.15156	.16794	1306.0	1.651	.97554	7.11534	.18842
23	180	.400	.050	.0985	1314.1	1.664	.98170	7.16026	.16265	1304.4	1.649	.97435	7.10664	.19304
24	180	.600	.075	.1478	1314.1	1.664	.98170	7.16026	.16265	1302.8	1.647	.97315	7.09794	.19755
25	180	.800	.100	.1971	1312.5	1.661	.98051	7.15156	.16794	1301.2	1.644	.97196	7.08924	.20197
26	180	1.000	.125	.2463	1310.9	1.659	.97931	7.14286	.17307	1299.6	1.642	.97077	7.08056	.20630
27	180	1.200	.150	.2956	1309.3	1.657	.97812	7.13416	.17806	1293.2	1.633	.96600	7.04575	.22285
28	180	1.400	.175	.3448	1306.1	1.652	.97573	7.11676	.18766	1290.0	1.628	.96361	7.02835	.23072
29	180	1.600	.200	.3941	1302.9	1.647	.97335	7.09936	.19682	1283.6	1.619	.95884	6.99356	.24577
30	180	1.800	.225	.4434	1296.5	1.638	.96858	7.06456	.21405	1275.7	1.607	.95288	6.95007	.26349
31	180	2.000	.250	.4926	1291.7	1.631	.96500	7.03846	.22618	1267.7	1.595	.94692	6.90658	.28023
32	180	2.200	.275	.5419	1283.7	1.619	.95904	6.99496	.24518	1258.1	1.581	.93976	6.85438	.29925
33	180	2.400	.300	.5912	1274.1	1.605	.95188	6.94276	.26637	1246.9	1.565	.93141	6.79350	.32022
34	180	2.600	.325	.6404	1263.0	1.588	.94353	6.88186	.28937	1236.1	1.546	.92187	6.72391	.34289
35	180	2.800	.350	.6897	1248.6	1.567	.93279	6.80356	.31683	1218.2	1.522	.90995	6.63692	.36966
36	180	3.000	.375	.7389	1234.2	1.546	.92206	6.72525	.34246	1202.2	1.499	.89802	6.54994	.39503
37	180	3.200	.400	.7882	1211.9	1.513	.90536	6.60345	.37957	1178.3	1.464	.88013	6.41946	.43101
38	180	3.400	.425	.8375	1186.3	1.476	.88627	6.46425	.41891	1151.1	1.424	.85986	6.27159	.46949
39	180	3.600	.450	.8867	1144.8	1.415	.85526	6.23804	.47794	1111.2	1.365	.83004	6.05413	.52280
40	180	3.800	.475	.9360	1082.5	1.323	.80874	5.89874	.55914	1047.3	1.271	.78234	5.70619	.60271
41	180	4.000	.500	.9852	966.0	1.151	.72166	5.26362	.69886	934.0	1.104	.69767	5.08860	.73600
42	270	1.000	.125	.2463	1333.2	1.692	.99601	7.26467	.07557	1341.1	1.703	1.00178	7.30670	.00000
43	270	2.000	.250	.4926	1326.8	1.682	.99124	7.22987	.11217	1336.7	1.694	.99701	7.27191	.06546
44	270	3.000	.375	.7389	1283.7	1.619	.95904	6.99496	.24518	1290.0	1.628	.96361	7.02835	.23072
45	270	4.000	.500	.9852	1020.3	1.231	.76222	5.55943	.63508	1026.6	1.260	.76684	5.59311	.62771
46	90	1.000	.125	.2463	1267.6	1.595	.94696	6.90692	.28010	1267.5	1.595	.94678	6.90554	.28062
47	90	2.000	.250	.4926	1218.0	1.522	.90995	6.63692	.36966	1217.9	1.522	.90976	6.63559	.37006
48	90	3.000	.375	.7389	1139.7	1.407	.85143	6.21013	.48490	1136.4	1.402	.84887	6.19148	.48952
49	90	4.000	.500	.9852	866.4	1.035	.64723	4.72075	.81350	863.1	1.000	.64471	4.70239	.81737

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE V.- DATA[a] FOR 160° CONE; $M_\infty = 2.30$ - Continued

(d) $\alpha = 15°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 2295.7 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.100	.000	.0000	1266.1	1.592	.94547	6.89599	.28418
2	0	.200	.025	.0493	1254.9	1.576	.93711	6.83504	.30604
3	0	.400	.050	.0985	1251.7	1.571	.93472	6.81763	.31205
4	0	.600	.075	.1478	1243.7	1.559	.92875	6.77409	.32667
5	0	.800	.100	.1971	1235.7	1.548	.92278	6.73056	.34078
6	0	1.000	.125	.2463	1227.7	1.536	.91682	6.68702	.35443
7	0	1.200	.150	.2956	1216.5	1.519	.90846	6.62607	.37289
8	0	1.400	.175	.3448	1205.9	1.505	.90130	6.57383	.38818
9	0	1.600	.200	.3941	1195.7	1.489	.89294	6.51288	.40548
10	0	1.800	.225	.4434	1184.5	1.472	.88458	6.45193	.42226
11	0	2.000	.250	.4926	1171.7	1.453	.87503	6.38227	.44089
12	0	2.200	.275	.5419	1159.0	1.435	.86548	6.31262	.45902
13	0	2.400	.300	.5912	1143.0	1.411	.85355	6.22555	.48106
14	0	2.500	.325	.6404	1128.6	1.390	.84280	6.14718	.50039
15	0	2.800	.350	.6897	1107.8	1.359	.82728	6.03399	.52758
16	0	3.000	.375	.7389	1093.4	1.338	.81654	5.95563	.54598
17	0	3.200	.400	.7882	1063.0	1.294	.79386	5.79019	.58387
18	0	3.400	.425	.8375	1039.1	1.258	.77595	5.65959	.61305
19	0	3.600	.450	.8867	1005.5	1.209	.75088	5.47674	.65308
20	0	3.800	.475	.9360	941.5	1.115	.70313	5.12846	.72756
21	0	4.000	.500	.9852	863.2	1.000	.64464	4.70181	.81749
22	180	.200	.025	.0493	1293.4	1.632	.96588	7.04489	.22325
23	180	.400	.050	.0985	1309.4	1.656	.97780	7.13186	.17935
24	180	.600	.075	.1478	1318.9	1.670	.98496	7.18405	.14730
25	180	.800	.100	.1971	1325.3	1.679	.98973	7.21884	.12153
26	180	1.000	.125	.2463	1331.7	1.689	.99450	7.25363	.08881
27	180	1.200	.150	.2956	1334.9	1.693	.99688	7.27102	.06679
28	180	1.400	.175	.3448	1338.1	1.698	.99927	7.28842	.03233
29	180	1.600	.200	.3941	1341.3	1.703	1.00165	7.30581	.00000
30	180	1.800	.225	.4434	1341.3	1.703	1.00165	7.30581	.00000
31	180	2.000	.250	.4926	1341.3	1.703	1.00165	7.30581	.00000
32	180	2.200	.275	.5419	1341.3	1.703	1.00165	7.30581	.00000
33	180	2.400	.300	.5912	1338.1	1.698	.99927	7.28842	.03233
34	180	2.500	.325	.6404	1333.3	1.691	.99569	7.26232	.07856
35	180	2.800	.350	.6897	1326.9	1.682	.99092	7.22753	.11422
36	180	3.000	.375	.7389	1317.3	1.668	.98377	7.17535	.15308
37	180	3.200	.400	.7882	1303.0	1.647	.97304	7.09707	.19800
38	180	3.400	.425	.8375	1283.8	1.618	.95873	6.99270	.24613
39	180	3.600	.450	.8867	1251.9	1.571	.93488	6.81876	.31166
40	180	3.800	.475	.9360	1194.4	1.487	.89195	6.50565	.40749
41	180	4.000	.500	.9852	1079.4	1.318	.80609	5.87944	.56358
42	270	1.000	.125	.2463	1267.8	1.595	.94680	6.90573	.28055
43	270	2.000	.250	.4926	1242.3	1.557	.92772	6.76657	.32914
44	270	3.000	.375	.7389	1181.6	1.468	.88241	6.43607	.42655
45	270	4.000	.500	.9852	915.6	1.078	.68446	4.99230	.75632
46	90	1.000	.125	.2463	1267.7	1.595	.94666	6.90470	.28094
47	90	2.000	.250	.4926	1242.1	1.557	.92756	6.76538	.32953
48	90	3.000	.375	.7389	1181.3	1.468	.88220	6.43452	.42697
49	90	4.000	.500	.9852	909.6	1.068	.67926	4.95432	.76433

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE V.- DATA[a] FOR 160° CONE; $M_\infty = 2.30$ - Continued

(e) $\alpha = 20°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 2291.4 psf					Φ = 22.5°, p_t = 2291.5 psf					Φ = 45.0°, p_t = 2292.9 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1205.2	1.506	.90173	6.57698	.38727	1206.8	1.508	.90289	6.58542	.38483	1207.1	1.508	.90253	6.58280	.38559
2	0	.200	.025	.0493	1192.4	1.487	.89216	6.50720	.40706	1195.6	1.492	.89451	6.52436	.40226	1197.5	1.494	.89536	6.53056	.40052
3	0	.400	.050	.0985	1194.0	1.490	.89336	6.51592	.40462	1195.6	1.492	.89451	6.52436	.40226	1199.1	1.496	.89656	6.53926	.39806
4	0	.600	.075	.1478	1187.6	1.480	.88857	6.48103	.41431	1190.8	1.485	.89093	6.49820	.40956	1196.3	1.489	.89298	6.51314	.40540
5	0	.800	.100	.1971	1179.7	1.468	.88259	6.43742	.42619	1182.8	1.473	.88495	6.45458	.42154	1187.9	1.479	.88820	6.47831	.41505
6	0	1.000	.125	.2463	1173.1	1.454	.87542	6.38508	.44015	1174.9	1.461	.87897	6.41097	.43328	1181.5	1.470	.88343	6.44348	.42455
7	0	1.200	.150	.2956	1162.1	1.442	.86944	6.34147	.45157	1166.9	1.449	.87299	6.36736	.44482	1173.6	1.458	.87746	6.39995	.43622
8	0	1.400	.175	.3448	1154.1	1.431	.86346	6.29785	.46280	1157.3	1.435	.86581	6.31502	.45840	1165.6	1.447	.87149	6.35641	.44768
9	0	1.600	.200	.3941	1141.3	1.412	.85389	6.22807	.48043	1147.7	1.421	.85864	6.26269	.47174	1157.6	1.435	.86552	6.31287	.45896
10	0	1.800	.225	.4434	1130.1	1.395	.84552	6.16701	.49554	1134.9	1.402	.84907	6.19291	.48916	1148.0	1.421	.85836	6.26063	.47225
11	0	2.000	.250	.4926	1117.3	1.377	.83595	6.09723	.51249	1123.7	1.386	.84070	6.13185	.50412	1135.8	1.404	.85000	6.19968	.48749
12	0	2.200	.275	.5419	1104.5	1.358	.82639	6.02745	.52913	1110.9	1.367	.83113	6.06207	.52091	1125.7	1.388	.84164	6.13872	.50245
13	0	2.400	.300	.5912	1088.5	1.334	.81443	5.94022	.54956	1096.5	1.346	.82037	5.98357	.53945	1112.9	1.369	.83209	6.06906	.51924
14	0	2.600	.325	.6404	1074.2	1.313	.80366	5.86172	.56763	1082.1	1.325	.80961	5.90507	.55768	1098.5	1.348	.82135	5.99070	.53778
15	0	2.330	.350	.6897	1056.6	1.287	.79051	5.76576	.58938	1064.6	1.299	.79645	5.80912	.57959	1082.5	1.324	.80941	5.90362	.55802
16	0	3.000	.375	.7389	1042.2	1.266	.77974	5.68726	.60692	1047.0	1.273	.78330	5.71318	.60115	1055.0	1.298	.79628	5.80784	.57988
17	0	3.230	.400	.7882	1013.4	1.223	.75822	5.53025	.64145	1023.0	1.237	.76536	5.58234	.63007	1041.0	1.263	.77837	5.67723	.60914
18	0	3.400	.425	.8375	992.6	1.193	.74267	5.41685	.66603	999.0	1.202	.74742	5.45151	.65854	1013.9	1.223	.75807	5.52920	.64168
19	0	3.600	.450	.8867	959.1	1.143	.71756	5.23367	.70524	963.9	1.150	.72111	5.25961	.69971	978.8	1.171	.73181	5.33764	.68304
20	0	3.800	.475	.9360	899.9	1.056	.67331	4.91093	.77346	906.3	1.066	.67806	4.94561	.76616	913.7	1.084	.68764	5.01547	.75144
21	0	4.000	.500	.9852	826.4	.948	.61829	4.50968	.85805	832.8	.957	.62305	4.54438	.85071	843.0	.972	.63034	4.59751	.83948
22	180	.200	.025	.0493	1243.8	1.563	.93059	6.78751	.32222	1242.2	1.560	.92936	6.77850	.32521	1235.8	1.550	.92402	6.73953	.33790
23	180	.400	.050	.0985	1270.9	1.603	.95090	6.93563	.26915	1266.2	1.596	.94728	6.90919	.27925	1253.4	1.576	.93715	6.83532	.30594
24	180	.600	.075	.1478	1283.7	1.622	.96046	7.00534	.24077	1278.9	1.615	.95683	6.97890	.25187	1263.0	1.590	.94431	6.88756	.28728
25	180	.800	.100	.1971	1294.9	1.638	.96882	7.06533	.21321	1286.9	1.626	.96281	7.02246	.23333	1270.9	1.602	.95028	6.93110	.27091
26	180	1.000	.125	.2463	1304.5	1.652	.97599	7.11861	.18666	1295.5	1.640	.96997	7.07474	.20915	1277.3	1.611	.95505	6.96593	.25716
27	180	1.230	.150	.2956	1312.5	1.664	.98196	7.16218	.16147	1304.5	1.652	.97595	7.11830	.18683	1282.1	1.618	.95864	6.99205	.24640
28	180	1.400	.175	.3448	1318.8	1.674	.98674	7.19703	.13823	1310.9	1.662	.98072	7.15315	.16699	1285.3	1.623	.96102	7.00946	.23899
29	180	1.600	.200	.3941	1325.2	1.683	.99152	7.23188	.11038	1315.7	1.669	.98431	7.17929	.15049	1286.9	1.625	.96222	7.01817	.23521
30	180	1.830	.225	.4434	1333.0	1.690	.99510	7.25802	.08379	1318.8	1.673	.98670	7.19671	.13845	1288.5	1.628	.96341	7.02688	.23138
31	180	2.000	.250	.4926	1333.2	1.695	.99749	7.27545	.05992	1320.4	1.676	.98789	7.20543	.13204	1290.1	1.630	.96461	7.03559	.22748
32	180	2.200	.275	.5419	1336.4	1.699	.99988	7.29287	.01310	1323.6	1.680	.99028	7.22285	.11821	1288.5	1.628	.96341	7.02688	.23138
33	180	2.400	.300	.5912	1338.0	1.702	1.00107	7.30159	.00000	1325.2	1.683	.99147	7.23156	.11066	1286.9	1.625	.96222	7.01817	.23521
34	180	2.630	.325	.6404	1338.0	1.702	1.00107	7.30159	.00000	1323.6	1.680	.99028	7.22285	.11821	1283.7	1.621	.95983	7.00076	.24272
35	180	2.800	.350	.6897	1338.0	1.702	1.00107	7.30159	.00000	1320.4	1.676	.98789	7.20543	.13204	1277.3	1.611	.95505	6.96593	.25716
36	180	3.030	.375	.7389	1333.2	1.695	.99749	7.27545	.05992	1315.7	1.669	.98431	7.17929	.15049	1269.4	1.599	.94909	6.92239	.27425
37	180	3.230	.400	.7882	1325.2	1.683	.99152	7.23188	.11038	1306.1	1.655	.97714	7.12701	.18206	1255.0	1.578	.93834	6.84402	.30290
38	180	3.400	.425	.8375	1310.9	1.662	.98077	7.15346	.16680	1293.3	1.636	.96758	7.05731	.21748	1239.0	1.555	.92640	6.75695	.33228
39	180	3.630	.450	.8867	1286.9	1.626	.96285	7.02277	.23320	1266.2	1.596	.94728	6.90919	.27925	1207.1	1.508	.90253	6.58280	.38559
40	180	3.830	.475	.9360	1237.4	1.554	.92581	6.75266	.33367	1213.5	1.518	.90786	6.62167	.37420	1151.2	1.425	.86074	6.27804	.46785
41	180	4.000	.500	.9852	1127.2	1.391	.84339	6.15146	.49934	1104.9	1.358	.82663	6.02921	.52871	1041.0	1.263	.77837	5.67723	.60914
42	270	1.000	.125	.2463	1219.9	1.528	.91267	6.65682	.36367	1247.0	1.568	.93294	6.80464	.31647	1275.7	1.609	.95386	6.95722	.26065
43	270	2.000	.250	.4926	1199.1	1.497	.89714	6.54354	.39684	1245.4	1.565	.93175	6.79593	.31940	1286.9	1.625	.96222	7.01817	.23521
44	270	3.000	.375	.7389	1144.8	1.417	.85653	6.24730	.47561	1207.1	1.509	.90308	6.58682	.38442	1270.9	1.602	.95028	6.93110	.27091
45	270	4.000	.500	.9852	894.1	1.048	.66878	4.87934	.78011	959.6	1.144	.71792	5.23635	.70667	1039.4	1.261	.77718	5.66852	.61108
46	90	1.000	.125	.2463	1216.4	1.523	.91010	6.63804	.36932	1195.6	1.492	.89451	6.52436	.40226	1179.9	1.468	.88223	6.43478	.42690
47	90	2.000	.250	.4926	1197.2	1.494	.89575	6.53337	.39972	1153.7	1.445	.87060	6.34991	.44937	1135.2	1.402	.84880	6.19097	.48964
48	90	3.000	.375	.7389	1144.5	1.417	.85628	6.24552	.47606	1098.1	1.348	.82157	5.99230	.53741	1065.0	1.298	.79628	5.80784	.57988
49	90	4.000	.500	.9852	883.9	1.033	.66135	4.82370	.79182	839.2	.967	.62783	4.57927	.84334	814.3	.929	.60885	4.44078	.87267

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE V.- DATA[a] FOR 160° CONE; $M_\infty = 2.30$ - Concluded

(e) $\alpha = 20°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 2293.5 psf					Φ = 90.0°, p_t = 2293.3 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1208.4	1.509	.90329	6.58839	.38397	1208.3	1.509	.90331	6.58851	.38393
2	0	.200	.025	.0493	1203.6	1.502	.89971	6.56225	.39151	1211.5	1.514	.90570	6.60594	.37884
3	0	.400	.050	.0985	1206.8	1.507	.90210	6.57968	.38649	1217.9	1.523	.91048	6.64080	.36850
4	0	.600	.075	.1478	1205.2	1.504	.90090	6.57096	.38901	1222.7	1.530	.91406	6.66694	.36059
5	0	.800	.100	.1971	1203.6	1.502	.89971	6.56225	.39151	1221.1	1.528	.91287	6.65823	.36324
6	0	1.000	.125	.2463	1198.8	1.495	.89612	6.53610	.39895	1221.1	1.528	.91287	6.65823	.36324
7	0	1.200	.150	.2956	1192.4	1.486	.89134	6.50124	.40872	1219.5	1.526	.91167	6.64951	.36588
8	0	1.400	.175	.3448	1187.6	1.479	.88776	6.47510	.41594	1216.3	1.521	.90928	6.63208	.37110
9	0	1.600	.200	.3941	1179.7	1.467	.88179	6.43152	.42778	1211.5	1.514	.90570	6.60594	.37884
10	0	1.800	.225	.4434	1173.3	1.457	.87701	6.39667	.43709	1206.7	1.507	.90211	6.57979	.38646
11	0	2.000	.250	.4926	1153.7	1.443	.86984	6.34438	.45082	1200.3	1.497	.89733	6.54493	.39645
12	0	2.200	.275	.5419	1152.5	1.427	.86147	6.28337	.46650	1194.0	1.488	.89256	6.51007	.40626
13	0	2.400	.300	.5912	1142.9	1.413	.85630	6.23108	.47968	1186.0	1.476	.88658	6.46650	.41829
14	0	2.600	.325	.6404	1130.1	1.394	.84475	6.16137	.49692	1176.8	1.460	.87822	6.40549	.43474
15	0	2.800	.350	.6897	1114.1	1.370	.83280	6.07422	.51801	1162.0	1.441	.86866	6.33577	.45305
16	0	3.000	.375	.7389	1098.1	1.347	.82085	5.98707	.53863	1147.6	1.420	.85790	6.25734	.47309
17	0	3.200	.400	.7882	1075.8	1.314	.80412	5.86506	.56687	1125.8	1.389	.84237	6.14405	.50115
18	0	3.400	.425	.8375	1053.2	1.276	.78500	5.72563	.59837	1101.3	1.352	.82325	6.00461	.53452
19	0	3.600	.450	.8867	1015.0	1.224	.75872	5.53390	.64066	1066.1	1.300	.79697	5.81288	.57874
20	0	3.800	.475	.9360	954.3	1.135	.71331	5.20274	.71181	1003.8	1.208	.75037	5.47299	.65389
21	0	4.000	.500	.9852	869.6	1.010	.64999	4.74085	.80926	915.8	1.078	.68465	4.99367	.75603
22	180	.200	.025	.0493	1226.2	1.535	.91661	6.68554	.35489	1216.6	1.521	.90947	6.63343	.37070
23	180	.400	.050	.0985	1237.4	1.552	.92497	6.74648	.33567	1219.8	1.526	.91185	6.65084	.36548
24	180	.600	.075	.1478	1242.2	1.559	.92855	6.77259	.32716	1221.4	1.528	.91305	6.65954	.36284
25	180	.800	.100	.1971	1247.0	1.566	.93213	6.79871	.31847	1221.4	1.528	.91305	6.65954	.36284
26	180	1.000	.125	.2463	1250.2	1.571	.93452	6.81612	.31256	1221.4	1.528	.91305	6.65954	.36284
27	180	1.200	.150	.2956	1251.8	1.573	.93571	6.82482	.30958	1219.8	1.526	.91185	6.65084	.36548
28	180	1.400	.175	.3448	1251.8	1.573	.93571	6.82482	.30958	1216.6	1.521	.90947	6.63343	.37070
29	180	1.600	.200	.3941	1251.8	1.573	.93571	6.82482	.30958	1213.4	1.517	.90708	6.61602	.37587
30	180	1.800	.225	.4434	1250.2	1.571	.93452	6.81612	.31256	1207.0	1.507	.90231	6.58120	.38605
31	180	2.000	.250	.4926	1245.4	1.564	.93093	6.79000	.32139	1202.2	1.500	.89873	6.55508	.39356
32	180	2.200	.275	.5419	1240.6	1.557	.92735	6.76389	.33002	1195.8	1.491	.89395	6.52026	.40341
33	180	2.400	.300	.5912	1235.8	1.549	.92377	6.73777	.33847	1187.8	1.479	.88798	6.47673	.41549
34	180	2.600	.325	.6404	1229.4	1.540	.91900	6.70295	.34948	1175.7	1.463	.87963	6.41580	.43199
35	180	2.800	.350	.6897	1219.9	1.526	.91184	6.65072	.36551	1162.3	1.441	.86889	6.33745	.45261
36	180	3.000	.375	.7389	1207.1	1.507	.90229	6.58108	.38609	1149.5	1.423	.85934	6.26781	.47044
37	180	3.200	.400	.7882	1191.1	1.484	.89036	6.49403	.41072	1127.2	1.390	.84263	6.14593	.50069
38	180	3.400	.425	.8375	1170.4	1.453	.87484	6.38086	.44127	1103.2	1.354	.82473	6.01535	.53199
39	180	3.600	.450	.8867	1135.2	1.401	.84858	6.18935	.49004	1063.3	1.296	.79489	5.79772	.58217
40	180	3.800	.475	.9360	1076.2	1.314	.80442	5.86726	.56637	1005.8	1.211	.75192	5.48433	.65144
41	180	4.000	.500	.9852	966.0	1.152	.72207	5.26660	.69822	895.7	1.049	.66957	4.88366	.77920
42	270	1.000	.125	.2463	1299.7	1.644	.97151	7.08598	.20361	1306.0	1.653	.97631	7.12092	.18541
43	270	2.000	.250	.4926	1323.6	1.679	.98942	7.21655	.12338	1334.7	1.695	.99779	7.27762	.05625
44	270	3.000	.375	.7389	1317.3	1.669	.98464	7.18173	.14886	1334.7	1.695	.99779	7.27762	.05625
45	270	4.000	.500	.9852	1103.3	1.354	.82471	6.01525	.53201	1127.2	1.390	.84263	6.14593	.50069
46	90	1.000	.125	.2463	1176.5	1.462	.87940	6.41410	.43245	1173.2	1.457	.87702	6.39678	.43706
47	90	2.000	.250	.4926	1123.7	1.384	.83997	6.12651	.50541	1120.4	1.380	.83759	6.10919	.50960
48	90	3.000	.375	.7389	1047.0	1.271	.78261	5.70820	.60226	1042.1	1.264	.77904	5.68215	.60805
49	90	4.000	.500	.9852	802.4	.911	.59981	4.37483	.88670	799.2	.907	.59743	4.35748	.89039

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VI.- DATA[a] FOR 160° CONE; $M_\infty = 2.96$

(a) $\alpha = 0°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 3241.9 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1088.4	1.730	.98800	11.61252	.13144
2	0	.200	.025	.0493	1088.4	1.730	.98800	11.61252	.13144
3	0	.400	.050	.0985	1085.2	1.725	.98509	11.57837	.14663
4	0	.600	.075	.1478	1083.6	1.722	.98364	11.56129	.15368
5	0	.800	.100	.1971	1082.0	1.719	.98219	11.54421	.16044
6	0	1.000	.125	.2463	1075.6	1.708	.97638	11.47590	.18512
7	0	1.200	.150	.2956	1072.4	1.703	.97347	11.44175	.19636
8	0	1.400	.175	.3448	1067.6	1.694	.96911	11.39052	.21219
9	0	1.600	.200	.3941	1061.2	1.683	.96330	11.32221	.23174
10	0	1.800	.225	.4434	1056.4	1.675	.95894	11.27097	.24547
11	0	2.000	.250	.4926	1048.4	1.661	.95168	11.18559	.26695
12	0	2.200	.275	.5419	1040.4	1.647	.94441	11.10020	.28701
13	0	2.400	.300	.5912	1032.4	1.633	.93715	11.01482	.30594
14	0	2.600	.325	.6404	1022.8	1.616	.92843	10.91235	.32745
15	0	2.800	.350	.6897	1010.0	1.594	.91681	10.77574	.35445
16	0	3.000	.375	.7389	995.5	1.569	.90373	10.62204	.38304
17	0	3.200	.400	.7882	973.1	1.530	.88339	10.38296	.42462
18	0	3.400	.425	.8375	950.7	1.491	.86305	10.14388	.46357
19	0	3.600	.450	.8867	920.3	1.438	.83544	9.81941	.51338
20	0	3.800	.475	.9360	864.3	1.341	.78459	9.22171	.59905
21	0	4.000	.500	.9852	787.5	1.207	.71485	8.40200	.70944
22	180	.200	.025	.0493	1093.1	1.739	.99230	11.66309	.10513
23	180	.400	.050	.0985	1089.9	1.733	.98941	11.62909	.12342
24	180	.600	.075	.1478	1088.3	1.730	.98796	11.61208	.13164
25	180	.800	.100	.1971	1085.2	1.725	.98507	11.57808	.14675
26	180	1.000	.125	.2463	1080.4	1.716	.98073	11.52708	.16696
27	180	1.200	.150	.2956	1075.6	1.708	.97639	11.47607	.18506
28	180	1.400	.175	.3448	1072.4	1.703	.97350	11.44207	.19626
29	180	1.600	.200	.3941	1067.6	1.694	.96916	11.39106	.21202
30	180	1.800	.225	.4434	1061.2	1.683	.96337	11.32306	.23150
31	180	2.000	.250	.4926	1054.9	1.672	.95759	11.25505	.24960
32	180	2.200	.275	.5419	1046.9	1.658	.95035	11.17004	.27070
33	180	2.400	.300	.5912	1038.9	1.644	.94312	11.08504	.29045
34	180	2.600	.325	.6404	1029.4	1.628	.93444	10.98303	.31275
35	180	2.800	.350	.6897	1016.6	1.606	.92287	10.84701	.34058
36	180	3.000	.375	.7389	1000.7	1.578	.90841	10.67700	.37301
37	180	3.200	.400	.7882	981.6	1.545	.89105	10.47298	.40932
38	180	3.400	.425	.8375	959.3	1.506	.87080	10.23496	.44900
39	180	3.600	.450	.8867	924.2	1.445	.83897	9.86092	.50717
40	180	3.800	.475	.9360	871.6	1.353	.79124	9.29987	.58818
41	180	4.000	.500	.9852	776.0	1.187	.70445	8.27977	.72553
42	270	1.000	.125	.2463	1077.2	1.711	.97784	11.49307	.17922
43	270	2.000	.250	.4926	1051.7	1.667	.95469	11.22105	.25822
44	270	3.000	.375	.7389	995.9	1.570	.90407	10.62599	.38232
45	270	4.000	.500	.9852	768.1	1.173	.69722	8.19477	.73669
46	90	1.000	.125	.2463	1075.6	1.708	.97638	11.47590	.18512
47	90	2.000	.250	.4926	1048.4	1.661	.95168	11.18559	.26695
48	90	3.000	.375	.7389	993.9	1.566	.90228	10.60496	.38612
49	90	4.000	.500	.9852	760.3	1.160	.69015	8.11169	.74758

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VI.- DATA[a] FOR 160° CONE; $M_\infty = 2.96$ - Continued

(b) $\alpha = 5°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 3239.0 psf					Φ = 22.5°, p_t = 3241.0 psf					Φ = 45.0°, p_t = 3240.7 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.030	.000	.0000	1079.4	1.716	.98073	11.52704	.16697	1079.1	1.715	.97985	11.51672	.17078	1081.3	1.719	.98196	11.54150	.16149
2	0	.230	.025	.0493	1074.6	1.708	.97637	11.47581	.18515	1075.9	1.709	.97695	11.48260	.18284	1078.1	1.713	.97906	11.50740	.17415
3	0	.400	.050	.0985	1071.4	1.703	.97346	11.44165	.19640	1072.7	1.704	.97404	11.44848	.19420	1074.9	1.708	.97616	11.47331	.18600
4	0	.630	.075	.1478	1058.2	1.697	.97056	11.40750	.20707	1057.9	1.695	.96369	11.39729	.21016	1071.7	1.702	.97325	11.43921	.19718
5	0	.800	.100	.1971	1063.4	1.689	.96620	11.35627	.22219	1063.1	1.687	.96533	11.36610	.22507	1068.5	1.697	.97035	11.40512	.20779
6	0	1.000	.125	.2463	1057.0	1.677	.96039	11.28796	.24099	1058.3	1.679	.96398	11.29492	.23914	1062.2	1.685	.96455	11.33692	.22765
7	0	1.230	.150	.2956	1052.2	1.669	.95603	11.23673	.25428	1051.9	1.667	.95517	11.22667	.25681	1057.4	1.677	.96020	11.28578	.24157
8	0	1.430	.175	.3448	1045.8	1.658	.95022	11.16842	.27108	1045.5	1.656	.94937	11.15842	.27347	1051.0	1.666	.95440	11.21759	.25908
9	0	1.600	.200	.3941	1039.4	1.647	.94440	11.10011	.28703	1043.7	1.648	.94501	11.10724	.28540	1044.6	1.655	.94860	11.14940	.27561
10	0	1.830	.225	.4434	1031.4	1.633	.93714	11.01472	.30596	1032.7	1.634	.93775	11.02193	.30440	1036.6	1.641	.94134	11.06416	.29513
11	0	2.000	.250	.4926	1021.8	1.616	.92842	10.91226	.32746	1024.7	1.620	.93049	10.93662	.32246	1028.6	1.627	.93409	10.97892	.31362
12	0	2.200	.275	.5419	1012.2	1.599	.91970	10.80980	.34788	1015.2	1.603	.92178	10.83425	.34309	1020.6	1.613	.92684	10.89368	.33124
13	0	2.430	.300	.5912	1001.0	1.580	.90953	10.69026	.37056	1004.0	1.584	.91162	10.71482	.36599	1011.0	1.596	.91814	10.79139	.35144
14	0	2.630	.325	.6404	989.8	1.560	.89936	10.57072	.39223	992.8	1.565	.90146	10.59538	.38783	999.9	1.577	.90798	10.67205	.37392
15	0	2.830	.350	.6897	975.5	1.535	.88629	10.41703	.41888	978.4	1.539	.88840	10.44183	.41466	985.5	1.552	.89493	10.51862	.40141
16	0	3.030	.375	.7389	961.1	1.510	.87321	10.26333	.44439	964.0	1.514	.87533	10.28827	.44032	971.1	1.527	.88188	10.36519	.42760
17	0	3.230	.400	.7882	938.7	1.471	.85287	10.02425	.48229	941.6	1.475	.85501	10.04941	.47839	948.8	1.488	.86157	10.12652	.46632
18	0	3.430	.425	.8375	916.3	1.432	.83253	9.78517	.51848	919.2	1.437	.83469	9.81054	.51471	924.8	1.446	.83981	9.87080	.50569
19	0	3.600	.450	.8867	884.3	1.377	.80347	9.44363	.56795	887.3	1.381	.80565	9.46931	.56431	894.4	1.394	.81225	9.54688	.55323
20	0	3.800	.475	.9360	828.3	1.279	.75262	8.84593	.65034	831.3	1.284	.75485	8.87214	.64680	838.5	1.296	.76149	8.95020	.63625
21	0	4.000	.500	.9852	756.4	1.154	.68724	8.07746	.75206	756.2	1.153	.68662	8.07024	.75300	761.9	1.163	.69187	8.13190	.74493
22	180	.230	.025	.0493	1088.6	1.732	.98905	11.62490	.12549	1089.5	1.733	.98926	11.62738	.12427	1089.3	1.733	.98921	11.62674	.12459
23	180	.430	.050	.0985	1090.2	1.735	.99050	11.64192	.11684	1091.1	1.736	.99071	11.64440	.11553	1089.3	1.733	.98921	11.62674	.12459
24	180	.630	.075	.1478	1088.6	1.732	.98905	11.62490	.12549	1089.5	1.733	.98926	11.62738	.12427	1087.7	1.730	.98776	11.60969	.13276
25	180	.800	.100	.1971	1088.6	1.732	.98905	11.62490	.12549	1087.9	1.730	.98782	11.61035	.13245	1086.1	1.727	.98631	11.59264	.14047
26	180	1.000	.125	.2463	1087.0	1.730	.98761	11.60788	.13360	1086.3	1.727	.98637	11.59333	.14017	1084.5	1.724	.98486	11.57560	.14780
27	180	1.230	.150	.2956	1085.4	1.727	.98616	11.59086	.14126	1084.7	1.724	.98492	11.57631	.14750	1081.3	1.719	.98196	11.54150	.16149
28	180	1.400	.175	.3448	1083.8	1.724	.98471	11.57384	.14853	1081.5	1.719	.98202	11.54226	.16120	1078.1	1.713	.97906	11.50740	.17415
29	180	1.600	.200	.3941	1080.6	1.719	.98181	11.53980	.16214	1079.9	1.716	.98057	11.52523	.16766	1074.9	1.708	.97616	11.47331	.18600
30	180	1.800	.225	.4434	1077.4	1.713	.97892	11.50576	.17474	1075.1	1.708	.97623	11.47416	.18571	1070.1	1.699	.97180	11.42216	.20255
31	180	2.000	.250	.4926	1072.6	1.705	.97457	11.45470	.19217	1070.3	1.699	.97188	11.42309	.20226	1065.3	1.691	.96745	11.37102	.21793
32	180	2.200	.275	.5419	1067.8	1.696	.97023	11.40364	.20824	1067.1	1.694	.96899	11.38904	.21263	1060.6	1.683	.96310	11.31988	.23238
33	180	2.400	.300	.5912	1059.9	1.682	.96299	11.31854	.23274	1059.2	1.680	.96174	11.30392	.23672	1052.6	1.669	.95585	11.23464	.25480
34	180	2.600	.325	.6404	1051.9	1.669	.95575	11.23344	.25511	1051.2	1.666	.95450	11.21880	.25878	1043.0	1.652	.94715	11.13235	.27960
35	180	2.800	.350	.6897	1042.3	1.652	.94706	11.13131	.27984	1040.0	1.647	.94436	11.09963	.28714	1031.8	1.633	.93699	11.01301	.30633
36	180	3.000	.375	.7389	1029.6	1.630	.93547	10.99515	.31017	1027.3	1.625	.93278	10.96344	.31687	1019.0	1.610	.92539	10.87663	.33668
37	180	3.200	.400	.7882	1012.1	1.599	.91954	10.80793	.34824	1009.7	1.594	.91684	10.77618	.35437	999.9	1.577	.90798	10.67205	.37392
38	180	3.400	.425	.8375	991.3	1.563	.90072	10.58666	.38939	989.0	1.558	.89801	10.55487	.39504	979.1	1.541	.88913	10.45043	.41319
39	180	3.600	.450	.8867	957.9	1.505	.87031	10.22924	.44992	957.1	1.502	.86905	10.21639	.45231	945.6	1.483	.85867	10.09242	.47168
40	180	3.800	.475	.9360	905.3	1.413	.82252	9.66756	.53577	902.8	1.408	.81980	9.63557	.54043	892.8	1.391	.81080	9.52984	.55567
41	180	4.000	.500	.9852	809.6	1.247	.73564	8.64634	.67706	807.1	1.241	.73290	8.61413	.68135	795.4	1.221	.72233	8.48991	.69783
42	270	1.000	.125	.2463	1072.6	1.705	.97457	11.45470	.19217	1078.3	1.713	.97913	11.50821	.17386	1086.1	1.727	.98631	11.59264	.14047
43	270	2.000	.250	.4926	1045.5	1.657	.94995	11.16535	.27182	1057.6	1.677	.96030	11.28690	.24127	1056.9	1.694	.96890	11.38807	.21292
44	270	3.000	.375	.7389	992.9	1.566	.90217	10.60368	.38635	1006.5	1.588	.91395	10.74213	.36085	1019.0	1.610	.92539	10.87663	.33668
45	270	4.000	.500	.9852	766.6	1.172	.69654	8.18679	.73774	780.0	1.194	.70827	8.32473	.71962	792.2	1.216	.71943	8.45581	.70233
46	90	1.000	.125	.2463	1069.8	1.700	.97201	11.42457	.20180	1064.7	1.690	.96878	11.36317	.22020	1060.6	1.683	.96310	11.31988	.23238
47	90	2.000	.250	.4926	1044.2	1.655	.96876	11.15134	.27515	1035.9	1.640	.94066	11.05605	.29693	1033.2	1.630	.93554	10.99596	.30999
48	90	3.000	.375	.7389	991.4	1.563	.90082	10.58780	.38919	980.0	1.542	.88985	10.45889	.41174	969.5	1.524	.88043	10.34814	.43044
49	90	4.000	.500	.9852	761.2	1.162	.69159	8.12870	.74535	748.2	1.139	.67936	7.98493	.76416	737.9	1.121	.67011	7.87618	.77837

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VI.- DATA[a] FOR 160° CONE; $M_\infty = 2.96$ - Continued

(b) $\alpha = 5°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 3241.6 psf					Φ = 90.0°, p_t = 3239.6 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.200	.000	.0000	1081.2	1.718	.98155	11.53669	.16333	1080.0	1.717	.98107	11.53102	.16548
2	0	.200	.025	.0493	1079.6	1.715	.98010	11.51965	.16971	1080.0	1.717	.98107	11.53102	.16548
3	0	.400	.050	.0985	1076.4	1.710	.97720	11.48557	.18182	1080.0	1.717	.98107	11.53102	.16548
4	0	.600	.075	.1478	1073.2	1.704	.97430	11.45149	.19322	1078.4	1.714	.97962	11.51398	.17178
5	0	.800	.100	.1971	1070.0	1.699	.97140	11.41741	.20402	1075.2	1.709	.97672	11.47992	.18376
6	0	1.000	.125	.2463	1065.2	1.690	.96705	11.36628	.21930	1072.0	1.703	.97382	11.44585	.19505
7	0	1.200	.150	.2956	1060.4	1.682	.96270	11.31516	.23367	1067.2	1.695	.96947	11.39476	.21092
8	0	1.400	.175	.3448	1055.6	1.674	.95835	11.26404	.24727	1062.4	1.687	.96512	11.34366	.22576
9	0	1.600	.200	.3941	1049.2	1.662	.95255	11.19587	.26444	1057.6	1.678	.96078	11.29256	.23977
10	0	1.800	.225	.4434	1042.8	1.651	.94675	11.12771	.28068	1051.3	1.667	.95498	11.22443	.25737
11	0	2.000	.250	.4926	1036.5	1.640	.94095	11.05955	.29615	1044.9	1.656	.94918	11.15630	.27397
12	0	2.200	.275	.5419	1028.5	1.626	.93370	10.97434	.31458	1036.9	1.642	.94194	11.07114	.29357
13	0	2.400	.300	.5912	1017.3	1.607	.92355	10.85506	.33898	1027.3	1.625	.93324	10.96894	.31572
14	0	2.600	.325	.6404	1006.1	1.587	.91341	10.73577	.36205	1017.8	1.609	.92455	10.86675	.33665
15	0	2.800	.350	.6897	991.7	1.562	.90036	10.58240	.39015	1005.0	1.587	.91296	10.73049	.36305
16	0	3.000	.375	.7389	977.4	1.537	.88731	10.42903	.41684	990.6	1.562	.89991	10.57720	.39108
17	0	3.200	.400	.7882	956.6	1.501	.86866	10.20750	.45342	969.9	1.525	.88108	10.35577	.42917
18	0	3.400	.425	.8375	932.6	1.460	.84671	9.95189	.49340	946.0	1.484	.85934	10.10028	.47045
19	0	3.600	.450	.8867	902.3	1.407	.81917	9.62811	.54151	915.7	1.431	.83180	9.77667	.51974
20	0	3.800	.475	.9360	866.4	1.310	.76842	9.03168	.62517	861.4	1.337	.78253	9.19756	.60239
21	0	4.000	.500	.9852	771.4	1.179	.70028	8.23076	.73197	783.3	1.201	.71153	8.36297	.71458
22	180	.200	.025	.0493	1086.0	1.726	.98590	11.58781	.14259	1084.3	1.724	.98470	11.57371	.14859
23	180	.400	.050	.0985	1086.0	1.726	.98590	11.58781	.14259	1082.4	1.721	.98325	11.55664	.15555
24	180	.600	.075	.1478	1084.4	1.724	.98445	11.57077	.14981	1079.2	1.716	.98034	11.52250	.16866
25	180	.800	.100	.1971	1081.2	1.718	.98155	11.53669	.16333	1076.0	1.710	.97744	11.48836	.18086
26	180	1.000	.125	.2463	1079.6	1.715	.98010	11.51965	.16971	1074.4	1.707	.97598	11.47129	.18668
27	180	1.200	.150	.2956	1076.4	1.710	.97720	11.48557	.18182	1069.6	1.699	.97163	11.42008	.20320
28	180	1.400	.175	.3448	1071.6	1.701	.97285	11.43445	.19869	1063.2	1.688	.96582	11.35180	.22346
29	180	1.600	.200	.3941	1065.8	1.693	.96850	11.38332	.21432	1063.0	1.682	.96291	11.31766	.23299
30	180	1.800	.225	.4434	1061.6	1.687	.96560	11.34924	.22419	1055.2	1.674	.95856	11.26644	.24665
31	180	2.000	.250	.4926	1057.2	1.676	.95980	11.28108	.24281	1047.2	1.660	.95129	11.18109	.26804
32	180	2.200	.275	.5419	1050.8	1.665	.95400	11.21292	.26024	1039.2	1.646	.94403	11.09574	.28803
33	180	2.400	.300	.5912	1041.2	1.649	.94530	11.11067	.28462	1031.2	1.632	.93677	11.01039	.30690
34	180	2.600	.325	.6404	1031.7	1.632	.93660	11.00842	.30732	1021.6	1.615	.92806	10.90797	.32834
35	180	2.800	.350	.6897	1018.9	1.610	.92500	10.87210	.33558	1007.2	1.590	.91498	10.75433	.35854
36	180	3.000	.375	.7389	1006.1	1.587	.91341	10.73577	.36205	994.4	1.568	.90337	10.61777	.38381
37	180	3.200	.400	.7882	988.5	1.557	.89746	10.54832	.39620	975.3	1.535	.88594	10.41293	.41957
38	180	3.400	.425	.8375	966.2	1.518	.87716	10.30975	.43679	951.3	1.493	.86415	10.15687	.46151
39	180	3.500	.450	.8867	932.6	1.460	.84671	9.95189	.49340	917.7	1.435	.83365	9.79839	.51651
40	180	3.600	.475	.9360	878.4	1.365	.79742	9.37250	.57800	863.3	1.340	.78427	9.21800	.59956
41	180	4.000	.500	.9852	784.1	1.201	.71188	8.36708	.71404	770.6	1.179	.70004	8.22792	.73234
42	270	1.000	.125	.2463	1087.6	1.729	.98735	11.60486	.13499	1090.4	1.735	.99051	11.64199	.11681
43	270	2.000	.250	.4926	1071.6	1.701	.97285	11.43445	.19869	1076.0	1.710	.97744	11.48836	.18086
44	270	3.000	.375	.7389	1028.5	1.626	.93370	10.97434	.31458	1031.2	1.632	.93677	11.01039	.30690
45	270	4.000	.500	.9852	804.9	1.237	.73072	8.58862	.68474	807.4	1.243	.73344	8.62054	.68050
46	90	1.000	.125	.2463	1057.2	1.676	.95980	11.28108	.24281	1057.6	1.678	.96078	11.29256	.23977
47	90	2.000	.250	.4926	1022.1	1.615	.92790	10.90618	.32870	1022.5	1.617	.92890	10.91785	.32632
48	90	3.000	.375	.7389	961.4	1.510	.87281	10.25862	.44516	963.3	1.509	.87238	10.25358	.44598
49	90	4.000	.500	.9852	731.4	1.110	.66403	7.80473	.78770	730.6	1.109	.66370	7.80089	.78821

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VI.- DATA[a] FOR 160° CONE; M_∞ = 2.96 - Continued

(c) α = 10°

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 3238.7 psf					Φ = 22.5°, p_t = 3241.5 psf					Φ = 45.0°, p_t = 3242.9 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1060.4	1.683	.96351	11.32473	.23104	1059.9	1.681	.96228	11.31024	.23501	1060.1	1.681	.96207	11.30771	.23569
2	0	.230	.025	.0493	1050.8	1.667	.95480	11.22225	.25792	1051.9	1.667	.95502	11.22494	.25724	1053.7	1.670	.95626	11.23949	.25357
3	0	.400	.050	.0985	1047.6	1.661	.95189	11.18809	.26634	1047.1	1.659	.95067	11.17376	.26980	1048.9	1.661	.95191	11.18832	.26628
4	0	.600	.075	.1478	1041.2	1.650	.94638	11.11976	.28252	1042.3	1.650	.94632	11.12258	.28187	1045.7	1.656	.94901	11.15421	.27447
5	0	.800	.100	.1971	1036.4	1.642	.94172	11.06852	.29416	1035.9	1.639	.94051	11.05435	.29731	1040.9	1.647	.94465	11.10305	.28636
6	0	1.000	.125	.2463	1028.4	1.628	.93445	10.98311	.31273	1029.5	1.628	.93470	10.98611	.31209	1034.6	1.636	.93885	11.03482	.30160
7	0	1.200	.150	.2956	1022.0	1.617	.92864	10.91479	.32695	1023.1	1.617	.92890	10.91787	.32632	1028.2	1.625	.93304	10.96660	.31621
8	0	1.400	.175	.3448	1014.0	1.603	.92137	10.82938	.34405	1015.2	1.603	.92164	10.83258	.34342	1021.8	1.614	.92724	10.89838	.33029
9	0	1.600	.200	.3941	1006.0	1.589	.91410	10.74398	.36050	1007.2	1.589	.91438	10.74728	.35988	1013.8	1.600	.91999	10.81310	.34723
10	0	1.800	.225	.4434	996.4	1.572	.90538	10.64149	.37951	999.2	1.575	.90713	10.66199	.37577	1005.8	1.586	.91273	10.72783	.36355
11	0	2.000	.250	.4926	986.8	1.555	.89666	10.53901	.39783	989.6	1.559	.89842	10.59963	.39420	996.2	1.569	.90402	10.62550	.38241
12	0	2.200	.275	.5419	977.2	1.539	.88795	10.43652	.41557	978.4	1.539	.88826	10.44022	.41493	988.2	1.556	.89677	10.54022	.39762
13	0	2.400	.300	.5912	966.0	1.519	.87777	10.31695	.43561	968.8	1.523	.87955	10.33786	.43215	977.0	1.536	.88661	10.42083	.41823
14	0	2.600	.325	.6404	954.8	1.500	.86760	10.19739	.45505	956.0	1.500	.86794	10.20139	.45440	965.8	1.517	.87645	10.30144	.43816
15	0	2.800	.350	.6897	940.4	1.475	.85452	10.04366	.47928	941.6	1.475	.85488	10.04786	.47863	951.4	1.492	.86339	10.14795	.46293
16	0	3.000	.375	.7389	926.0	1.449	.84144	9.88993	.50280	927.2	1.450	.84181	9.89432	.50214	937.0	1.467	.85033	9.99445	.48689
17	0	3.200	.400	.7882	902.0	1.408	.81964	9.63371	.54070	903.2	1.408	.82004	9.63844	.54001	916.2	1.430	.83147	9.77273	.52032
18	0	3.400	.425	.8375	881.2	1.372	.80075	9.41166	.57248	880.9	1.370	.79972	9.39961	.57418	892.2	1.389	.80970	9.51690	.55752
19	0	3.600	.450	.8867	852.4	1.321	.77459	9.10420	.61525	850.5	1.317	.77215	9.07548	.61918	861.9	1.336	.78213	9.19284	.60304
20	0	3.800	.475	.9360	798.1	1.227	.72518	8.52344	.69339	797.7	1.225	.72425	8.51253	.69483	807.5	1.241	.73280	8.61296	.68150
21	0	4.000	.500	.9852	729.3	1.107	.66269	7.78896	.78977	727.4	1.103	.66039	7.76193	.79330	735.5	1.116	.66750	7.84547	.78238
22	180	.200	.025	.0493	1076.0	1.711	.97770	11.49140	.17980	1077.1	1.711	.97789	11.49369	.17900	1076.5	1.709	.97694	11.48256	.18285
23	180	.400	.050	.0985	1083.9	1.724	.98494	11.57652	.14741	1083.5	1.722	.98368	11.56170	.15352	1079.7	1.715	.97984	11.51663	.17081
24	180	.600	.075	.1478	1087.1	1.730	.98783	11.61057	.13235	1086.7	1.728	.98657	11.59571	.13912	1081.3	1.718	.98129	11.53367	.16448
25	180	.800	.100	.1971	1088.7	1.733	.98928	11.62760	.12417	1088.3	1.730	.98802	11.61271	.13135	1082.9	1.720	.98274	11.55071	.15790
26	180	1.000	.125	.2463	1090.3	1.736	.99073	11.64462	.11542	1088.3	1.730	.98802	11.61271	.13135	1084.5	1.723	.98419	11.56774	.15106
27	180	1.200	.150	.2956	1091.9	1.738	.99218	11.66165	.10597	1089.9	1.733	.98946	11.62971	.12311	1082.9	1.720	.98274	11.55071	.15790
28	180	1.400	.175	.3448	1091.9	1.738	.99218	11.66165	.10597	1089.9	1.733	.98946	11.62971	.12311	1082.9	1.720	.98274	11.55071	.15790
29	180	1.600	.200	.3941	1090.3	1.736	.99073	11.64462	.11542	1088.3	1.730	.98802	11.61271	.13135	1079.7	1.715	.97984	11.51663	.17081
30	180	1.800	.225	.4434	1088.7	1.733	.98928	11.62760	.12417	1086.7	1.728	.98657	11.59571	.13912	1076.5	1.709	.97694	11.48256	.18285
31	180	2.000	.250	.4926	1085.5	1.727	.98639	11.59355	.14008	1085.5	1.722	.98368	11.56170	.15352	1073.3	1.704	.97404	11.44849	.19419
32	180	2.200	.275	.5419	1083.9	1.724	.98494	11.57652	.14741	1080.3	1.717	.98078	11.52770	.16672	1068.5	1.695	.96970	11.39738	.21013
33	180	2.400	.300	.5912	1077.6	1.713	.97914	11.50843	.17378	1073.9	1.705	.97500	11.45969	.19054	1062.2	1.686	.96390	11.32923	.22980
34	180	2.600	.325	.6404	1072.8	1.705	.97480	11.45735	.19130	1067.5	1.694	.96921	11.39168	.21184	1055.8	1.673	.95810	11.26109	.24804
35	180	2.800	.350	.6897	1064.8	1.691	.96756	11.37223	.21758	1059.6	1.680	.96198	11.30667	.23598	1046.2	1.656	.94940	11.15887	.27336
36	180	3.000	.375	.7389	1055.2	1.675	.95887	11.27009	.24570	1050.0	1.664	.95330	11.20465	.26229	1035.0	1.637	.93926	11.03961	.30055
37	180	3.200	.400	.7882	1040.9	1.650	.94583	11.11687	.28319	1035.7	1.639	.94028	11.05163	.29791	1017.4	1.606	.92331	10.85221	.33955
38	180	3.400	.425	.8375	1021.8	1.616	.92845	10.91258	.32740	1013.4	1.600	.92003	10.81359	.34714	996.7	1.570	.90447	10.63074	.38147
39	180	3.600	.450	.8867	993.1	1.566	.90238	10.60614	.38591	984.7	1.550	.89399	10.50755	.40334	966.3	1.518	.87693	10.30705	.43724
40	180	3.800	.475	.9360	942.1	1.477	.85603	10.06136	.47653	933.7	1.461	.84770	9.96347	.49164	913.6	1.426	.82910	9.74484	.52444
41	180	4.000	.500	.9852	846.4	1.311	.76912	9.03990	.62405	838.1	1.295	.76090	8.94332	.63718	816.2	1.256	.74068	8.70562	.66915
42	270	1.000	.125	.2463	1055.2	1.675	.95887	11.27009	.24570	1067.5	1.694	.96921	11.39168	.21184	1079.7	1.715	.97984	11.51663	.17081
43	270	2.000	.250	.4926	1032.9	1.636	.93859	11.03175	.30227	1051.6	1.667	.95474	11.22165	.25807	1071.7	1.701	.97259	11.43145	.19964
44	270	3.000	.375	.7389	981.9	1.547	.89224	10.48697	.40691	1005.4	1.586	.91279	10.72858	.36341	1031.8	1.631	.93636	11.00556	.30794
45	270	4.000	.500	.9852	758.8	1.158	.68946	8.10357	.74864	785.5	1.204	.71317	8.38223	.71204	814.6	1.254	.73923	8.68858	.67163
46	90	1.000	.125	.2463	1055.6	1.675	.95916	11.27349	.24481	1043.9	1.653	.94777	11.13964	.27790	1036.2	1.639	.94030	11.05188	.29785
47	90	2.000	.250	.4926	1033.2	1.636	.93881	11.03436	.30170	1013.6	1.600	.92019	10.81552	.34676	1001.0	1.578	.90838	10.67666	.37307
48	90	3.000	.375	.7389	980.4	1.544	.89085	10.47068	.40972	956.0	1.500	.86794	10.20139	.45440	938.6	1.469	.85178	10.01150	.48426
49	90	4.000	.500	.9852	753.3	1.149	.68449	8.04517	.75628	729.0	1.105	.66184	7.77899	.79107	711.6	1.074	.64573	7.58964	.81580

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VI.- DATA[a] FOR 160° CONE; $M_\infty = 2.96$ - Continued

(c) $\alpha = 10°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 3242.6 psf					Φ = 90.0°, p_t = 3241.7 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1060.4	1.681	.96240	11.31167	.23462	1060.4	1.682	.96267	11.31481	.23376
2	0	.200	.025	.0493	1055.6	1.673	.95806	11.26056	.24817	1060.4	1.682	.96267	11.31481	.23376
3	0	.400	.050	.0985	1054.0	1.670	.95661	11.24353	.25255	1058.8	1.679	.96122	11.29777	.23837
4	0	.600	.075	.1478	1050.8	1.665	.95371	11.20946	.26110	1058.8	1.679	.96122	11.29777	.23837
5	0	.800	.100	.1971	1047.6	1.659	.95081	11.17539	.26941	1055.6	1.673	.95832	11.26369	.24736
6	0	1.000	.125	.2463	1042.8	1.651	.94646	11.12428	.28148	1052.4	1.668	.95542	11.22961	.25607
7	0	1.200	.150	.2956	1036.5	1.640	.94066	11.05614	.29691	1049.2	1.662	.95252	11.19553	.26453
8	0	1.400	.175	.3448	1033.1	1.629	.93486	10.98799	.31169	1044.4	1.654	.94817	11.14441	.27678
9	0	1.600	.200	.3941	1025.3	1.620	.93052	10.93689	.32240	1039.6	1.646	.94382	11.09329	.28858
10	0	1.800	.225	.4434	1018.9	1.609	.92472	10.86874	.33625	1034.9	1.637	.93947	11.04217	.29999
11	0	2.000	.250	.4926	1010.9	1.595	.91747	10.78357	.35295	1028.5	1.626	.93367	10.97400	.31465
12	0	2.200	.275	.5419	1002.9	1.581	.91022	10.69839	.36905	1022.1	1.615	.92788	10.90584	.32877
13	0	2.400	.300	.5912	993.3	1.565	.90153	10.59617	.38769	1014.1	1.601	.92063	10.82064	.34576
14	0	2.600	.325	.6404	983.8	1.548	.89283	10.49396	.40570	1004.5	1.585	.91193	10.71840	.36532
15	0	2.800	.350	.6897	969.4	1.523	.87979	10.34064	.43169	991.7	1.562	.90033	10.58208	.39021
16	0	3.000	.375	.7389	955.0	1.498	.86674	10.18732	.45666	979.0	1.540	.88873	10.44575	.41399
17	0	3.200	.400	.7882	932.6	1.459	.86645	9.94882	.49387	958.2	1.504	.86988	10.22423	.45073
18	0	3.400	.425	.8375	911.9	1.423	.82761	9.72736	.52702	937.4	1.468	.85104	10.00270	.48562
19	0	3.600	.450	.8867	881.5	1.370	.80007	9.40368	.57361	907.1	1.415	.82349	9.67894	.53411
20	0	3.800	.475	.9360	825.7	1.273	.74934	8.80743	.65552	851.2	1.318	.77275	9.08252	.61822
21	0	4.000	.500	.9852	752.2	1.145	.68267	8.02379	.75908	776.1	1.187	.70461	8.28162	.72529
22	180	.200	.025	.0493	1071.6	1.701	.97255	11.43092	.19981	1063.4	1.696	.96992	11.40001	.20934
23	180	.400	.050	.0985	1074.8	1.706	.97545	11.46499	.18878	1066.8	1.693	.96847	11.38297	.21443
24	180	.600	.075	.1478	1074.8	1.706	.97545	11.46499	.18878	1063.6	1.687	.96557	11.34889	.22428
25	180	.800	.100	.1971	1074.8	1.706	.97545	11.46499	.18878	1062.0	1.685	.96412	11.33185	.22907
26	180	1.000	.125	.2463	1073.2	1.704	.97400	11.44796	.19437	1060.4	1.682	.96267	11.31481	.23376
27	180	1.200	.150	.2956	1070.0	1.698	.97110	11.41388	.20511	1055.6	1.673	.95832	11.26369	.24736
28	180	1.400	.175	.3448	1066.8	1.692	.96820	11.37981	.21536	1052.4	1.668	.95542	11.22961	.25607
29	180	1.600	.200	.3941	1065.2	1.690	.96675	11.36278	.22032	1047.6	1.660	.95107	11.17849	.26866
30	180	1.800	.225	.4434	1052.0	1.684	.96385	11.32871	.22994	1042.8	1.651	.94672	11.12737	.28076
31	180	2.000	.250	.4926	1055.6	1.673	.95806	11.26056	.24817	1034.9	1.637	.93947	11.04217	.29999
32	180	2.200	.275	.5419	1050.8	1.665	.95371	11.20946	.26110	1028.5	1.626	.93367	10.97400	.31465
33	180	2.400	.300	.5912	1044.4	1.654	.94791	11.14131	.27751	1020.5	1.612	.92643	10.88880	.33223
34	180	2.600	.325	.6404	1034.9	1.637	.93921	11.03910	.30066	1010.9	1.596	.91773	10.78656	.35237
35	180	2.800	.350	.6897	1023.7	1.617	.92907	10.91985	.32591	998.1	1.573	.90613	10.65024	.37792
36	180	3.000	.375	.7389	1010.9	1.595	.91747	10.78357	.35295	983.8	1.548	.89308	10.49687	.40519
37	180	3.200	.400	.7882	993.3	1.565	.90153	10.59617	.38769	966.2	1.518	.87713	10.30943	.43685
38	180	3.400	.425	.8375	971.0	1.526	.88124	10.35767	.42885	943.8	1.479	.85683	10.07086	.47505
39	180	3.600	.450	.8867	939.0	1.470	.85225	10.01696	.48342	910.3	1.421	.82639	9.71302	.52912
40	180	3.800	.475	.9360	886.3	1.379	.80442	9.45479	.56637	857.6	1.329	.77855	9.15068	.60886
41	180	4.000	.500	.9852	792.1	1.215	.71890	8.44968	.70314	765.0	1.168	.69446	8.16234	.74094
42	270	1.000	.125	.2463	1089.2	1.731	.98849	11.61831	.12869	1092.4	1.737	.99167	11.65562	.10940
43	270	2.000	.250	.4926	1082.8	1.720	.98270	11.55017	.15811	1087.6	1.729	.98732	11.60450	.13516
44	270	3.000	.375	.7389	1050.8	1.665	.95371	11.20946	.26110	1055.6	1.673	.95832	11.26369	.24736
45	270	4.000	.500	.9852	833.6	1.287	.75659	8.89261	.64404	843.2	1.304	.76550	8.99732	.62985
46	90	1.000	.125	.2463	1030.1	1.629	.93486	10.98799	.31169	1028.5	1.626	.93367	10.97400	.31465
47	90	2.000	.250	.4926	991.7	1.562	.90008	10.57914	.39074	986.9	1.554	.89598	10.53095	.39925
48	90	3.000	.375	.7389	929.5	1.454	.84355	9.91475	.49905	924.7	1.446	.83944	9.86638	.50635
49	90	4.000	.500	.9852	704.3	1.062	.63919	7.51272	.82586	701.1	1.057	.63646	7.48073	.83005

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VI.- DATA[a] FOR 160° CONE; $M_\infty = 2.96$ - Continued

(d) $\alpha = 15°$

Orifice	θ, deg	s, in.	s/D	s/s*	$\Phi = 0.0°$, $p_t = 3240.5$ psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1024.9	1.621	.93077	10.93983	.32180
2	0	.200	.025	.0493	1015.3	1.604	.92205	10.83743	.34247
3	0	.400	.050	.0985	1012.1	1.598	.91915	10.80329	.34914
4	0	.600	.075	.1478	1007.3	1.590	.91479	10.75209	.35896
5	0	.800	.100	.1971	1000.9	1.579	.90899	10.68383	.37175
6	0	1.000	.125	.2463	992.9	1.565	.90173	10.59849	.38728
7	0	1.200	.150	.2956	986.5	1.554	.89592	10.53023	.39938
8	0	1.400	.175	.3448	978.5	1.540	.88866	10.44489	.41414
9	0	1.600	.200	.3941	968.9	1.523	.87994	10.34249	.43138
10	0	1.800	.225	.4434	960.9	1.509	.87268	10.25716	.44540
11	0	2.000	.250	.4926	951.3	1.493	.86397	10.15476	.46185
12	0	2.200	.275	.5419	940.1	1.473	.85381	10.03529	.48058
13	0	2.400	.300	.5912	929.0	1.454	.84364	9.91582	.49889
14	0	2.600	.325	.6404	916.2	1.431	.83203	9.77929	.51935
15	0	2.800	.350	.6897	901.8	1.406	.81896	9.62568	.54186
16	0	3.000	.375	.7389	889.0	1.384	.80734	9.48915	.56148
17	0	3.200	.400	.7882	863.4	1.340	.78411	9.21608	.59983
18	0	3.400	.425	.8375	844.2	1.306	.76668	9.01128	.62795
19	0	3.600	.450	.8867	817.0	1.259	.74200	8.72114	.66708
20	0	3.800	.475	.9360	764.3	1.167	.69408	8.15794	.74152
21	0	4.000	.500	.9852	700.3	1.056	.63600	7.47527	.83076
22	180	.200	.025	.0493	1051.8	1.667	.95517	11.22668	.25681
23	180	.400	.050	.0985	1064.5	1.690	.96675	11.36276	.22032
24	180	.600	.075	.1478	1072.5	1.704	.97399	11.44781	.19441
25	180	.800	.100	.1971	1077.3	1.712	.97833	11.49884	.17720
26	180	1.000	.125	.2463	1083.6	1.723	.98412	11.56688	.15141
27	180	1.200	.150	.2956	1085.2	1.726	.98556	11.58389	.14428
28	180	1.400	.175	.3448	1090.0	1.734	.98991	11.63492	.12048
29	180	1.600	.200	.3941	1090.0	1.734	.98991	11.63492	.12048
30	180	1.800	.225	.4434	1090.0	1.734	.98991	11.63492	.12048
31	180	2.000	.250	.4926	1091.6	1.737	.99135	11.65193	.11146
32	180	2.200	.275	.5419	1090.0	1.734	.98991	11.63492	.12048
33	180	2.400	.300	.5912	1088.4	1.731	.98846	11.61791	.12889
34	180	2.600	.325	.6404	1085.2	1.726	.98556	11.58389	.14428
35	180	2.800	.350	.6897	1082.0	1.720	.98267	11.54987	.15823
36	180	3.000	.375	.7389	1074.1	1.706	.97543	11.46482	.18884
37	180	3.200	.400	.7882	1064.5	1.690	.96675	11.36276	.22032
38	180	3.400	.425	.8375	1050.2	1.665	.95372	11.20967	.26105
39	180	3.600	.450	.8867	1024.7	1.620	.93057	10.93750	.32228
40	180	3.800	.475	.9360	978.5	1.540	.88860	10.44421	.41425
41	180	4.000	.500	.9852	884.4	1.376	.80321	9.44061	.56838
42	270	1.000	.125	.2463	1027.9	1.626	.93346	10.97152	.31518
43	270	2.000	.250	.4926	1008.7	1.593	.91610	10.76740	.35605
44	270	3.000	.375	.7389	962.5	1.512	.87413	10.27411	.44264
45	270	4.000	.500	.9852	745.8	1.135	.67730	7.96073	.76732
46	90	1.000	.125	.2463	1028.1	1.626	.93367	10.97396	.31466
47	90	2.000	.250	.4926	1010.5	1.596	.91770	10.78623	.35244
48	90	3.000	.375	.7389	962.5	1.512	.87414	10.27422	.44262
49	90	4.000	.500	.9852	740.3	1.125	.67230	7.90194	.77501

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VI.- DATA[a] FOR 160° CONE; $M_\infty = 2.96$ - Continued

(e) $\alpha = 20°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 3242.1 psf					Φ = 22.5°, p_t = 3241.9 psf					Φ = 45.0°, p_t = 3242.8 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	972.1	1.528	.88241	10.37150	.42654	972.5	1.529	.88282	10.37623	.42575	972.7	1.529	.88275	10.37551	.42587
2	0	.200	.025	.0493	962.5	1.511	.87371	10.26915	.44344	962.9	1.512	.87412	10.27400	.44265	967.9	1.520	.87841	10.32440	.43438
3	0	.400	.050	.0985	964.1	1.514	.87516	10.28621	.44066	964.5	1.515	.87557	10.29104	.43987	964.7	1.515	.87551	10.29033	.43998
4	0	.600	.075	.1478	962.5	1.511	.87371	10.26915	.44344	961.3	1.509	.87267	10.25696	.44543	961.5	1.509	.87261	10.25625	.44554
5	0	.800	.100	.1971	954.5	1.497	.86645	10.18386	.45721	956.5	1.501	.86832	10.20585	.45369	955.1	1.498	.86681	10.18811	.45653
6	0	1.000	.125	.2463	948.1	1.486	.86364	10.11563	.46803	950.2	1.490	.86252	10.13770	.46455	948.8	1.487	.86101	10.11996	.46735
7	0	1.200	.150	.2956	941.7	1.475	.85484	10.04739	.47870	942.2	1.476	.85527	10.05250	.47791	944.0	1.479	.85666	10.06885	.47537
8	0	1.400	.175	.3448	933.8	1.461	.84758	9.96210	.49184	935.8	1.465	.84947	9.98435	.48844	936.0	1.465	.84942	9.98366	.48854
9	0	1.600	.200	.3941	924.2	1.445	.83887	9.85975	.50735	927.8	1.451	.84223	9.89916	.50141	929.6	1.454	.86362	9.91551	.49893
10	0	1.800	.225	.4434	914.6	1.428	.83017	9.75740	.52259	919.8	1.437	.83498	9.81397	.51419	921.6	1.440	.83637	9.83033	.51175
11	0	2.000	.250	.4926	906.6	1.414	.82291	9.67211	.53511	908.6	1.418	.82483	9.69470	.53181	912.0	1.423	.82767	9.72811	.52691
12	0	2.200	.275	.5419	895.4	1.395	.81275	9.55270	.55239	900.6	1.404	.81758	9.60951	.54420	902.4	1.406	.81938	9.62589	.54183
13	0	2.400	.300	.5912	882.6	1.372	.80114	9.41623	.57183	889.5	1.384	.80744	9.49025	.56133	889.7	1.384	.80738	9.48959	.56142
14	0	2.600	.325	.6404	873.0	1.356	.79243	9.31388	.58622	876.7	1.362	.79584	9.35394	.58061	876.9	1.362	.79578	9.35329	.58070
15	0	2.800	.350	.6897	857.0	1.328	.77792	9.14330	.60988	862.3	1.337	.78279	9.20060	.60197	864.1	1.340	.78419	9.21700	.59970
16	0	3.000	.375	.7389	845.8	1.308	.76776	9.02389	.62623	849.5	1.315	.77120	9.06429	.62071	843.3	1.304	.76534	8.99552	.63009
17	0	3.200	.400	.7882	823.4	1.269	.74744	8.78507	.65852	828.8	1.279	.75235	8.84280	.65076	822.6	1.268	.74650	8.77404	.66000
18	0	3.400	.425	.8375	807.4	1.242	.73293	8.61449	.68130	809.6	1.245	.73495	8.63834	.67813	795.4	1.220	.72186	8.48441	.69855
19	0	3.500	.450	.8867	780.3	1.194	.70825	8.32450	.71965	784.1	1.201	.71176	8.36573	.71422	747.5	1.137	.67837	7.97330	.76568
20	0	3.800	.475	.9360	732.3	1.111	.66471	7.81274	.78666	736.2	1.118	.66827	7.85458	.78119	582.0	1.023	.61894	7.27478	.85705
21	0	4.000	.500	.9852	673.1	1.008	.61101	7.18158	.86931	673.9	1.009	.61174	7.19010	.86819	1003.1	1.581	.91030	10.69921	.36890
22	180	.200	.025	.0493	1011.4	1.596	.91811	10.79104	.35151	1008.1	1.591	.91514	10.75617	.35819	1019.0	1.609	.92479	10.86958	.33609
23	180	.400	.050	.0985	1033.8	1.635	.93838	11.02933	.30280	1030.4	1.630	.93541	10.99444	.31032	1028.6	1.626	.93349	10.97181	.31512
24	180	.600	.075	.1478	1046.5	1.657	.94997	11.16549	.27178	1041.6	1.649	.94555	11.11357	.28395	1036.6	1.640	.94074	11.05699	.29672
25	180	.800	.100	.1971	1057.7	1.677	.96010	11.28464	.24187	1052.8	1.668	.95559	11.23271	.25529	1043.0	1.651	.94653	11.12514	.28128
26	180	1.000	.125	.2463	1065.7	1.691	.96734	11.36974	.21830	1059.2	1.680	.96148	11.30078	.23756	1047.8	1.659	.95088	11.17625	.26920
27	180	1.200	.150	.2956	1073.7	1.705	.97458	11.45484	.19213	1065.5	1.691	.96727	11.36886	.21856	1049.4	1.662	.95233	11.19329	.26507
28	180	1.400	.175	.3448	1078.5	1.713	.97893	11.50591	.17469	1071.9	1.702	.97306	11.43694	.19790	1052.6	1.668	.95523	11.22736	.25664
29	180	1.600	.200	.3941	1084.8	1.724	.98472	11.57399	.14847	1076.7	1.710	.97741	11.48800	.18098	1055.8	1.673	.95813	11.26143	.24795
30	180	1.800	.225	.4434	1089.6	1.732	.98907	11.62505	.12542	1079.9	1.716	.98030	11.52203	.16883	1055.8	1.673	.95813	11.26143	.24795
31	180	2.000	.250	.4926	1092.8	1.738	.99196	11.65909	.10744	1083.1	1.721	.98320	11.55607	.15578	1057.4	1.676	.95958	11.27867	.24350
32	180	2.230	.275	.5419	1096.0	1.744	.99486	11.69313	.09585	1086.3	1.727	.98609	11.59011	.14158	1055.8	1.673	.95813	11.26143	.24795
33	180	2.400	.300	.5912	1097.6	1.746	.99631	11.71015	.07273	1087.9	1.729	.98754	11.60713	.13395	1054.2	1.670	.95668	11.24440	.25233
34	180	2.600	.325	.6404	1099.2	1.749	.99775	11.72717	.05668	1086.3	1.727	.98609	11.59011	.14158	1051.0	1.665	.95378	11.21032	.26089
35	180	2.800	.350	.6897	1099.2	1.749	.99775	11.72717	.05668	1083.1	1.721	.98320	11.55607	.15578	1044.6	1.654	.94798	11.14218	.27731
36	180	3.000	.375	.7389	1097.6	1.746	.99631	11.71015	.07273	1081.1	1.717	.97596	11.47098	.18678	1035.0	1.637	.93929	11.03995	.30047
37	180	3.200	.400	.7882	1091.2	1.735	.99051	11.64207	.11677	1075.1	1.707	.96582	11.35184	.22345	1020.6	1.612	.92624	10.88662	.33267
38	180	3.400	.425	.8375	1080.0	1.716	.98038	11.52293	.16850	1063.9	1.688	.96582	11.35184	.22345	996.7	1.570	.90450	10.63107	.38141
39	180	3.500	.450	.8867	1059.3	1.680	.96155	11.30166	.23733	1043.2	1.652	.94700	11.13059	.28001	951.9	1.493	.86391	10.15403	.46196
40	180	3.800	.475	.9360	1019.4	1.610	.92535	10.87614	.33477	1003.1	1.577	.90790	10.67107	.37410	859.3	1.331	.77984	9.16589	.60676
41	180	4.000	.500	.9852	931.7	1.458	.84570	9.94001	.49521	910.8	1.421	.82681	9.71799	.52839	1041.4	1.648	.94508	11.10810	.28521
42	270	1.000	.125	.2463	990.7	1.560	.89928	10.56977	.39240	1014.5	1.602	.92093	10.82425	.34506	1055.8	1.673	.95813	11.26143	.24795
43	270	2.000	.250	.4926	977.9	1.538	.88770	10.43361	.41606	1014.5	1.602	.92093	10.82425	.34506	1041.4	1.648	.94508	11.10810	.28521
44	270	3.000	.375	.7389	934.9	1.463	.84860	9.97405	.49002	985.8	1.552	.89487	10.51790	.40153	852.9	1.320	.77404	9.09774	.61613
45	270	4.000	.500	.9852	727.5	1.102	.66034	7.76138	.79337	786.4	1.205	.71387	8.39049	.71096	955.1	1.498	.86681	10.18811	.45653
46	90	1.000	.125	.2463	986.5	1.553	.89548	10.52503	.40029	967.7	1.520	.87847	10.32511	.43426	921.6	1.440	.83637	9.83033	.51175
47	90	2.000	.250	.4926	975.3	1.534	.88532	10.40562	.42081	963.8	1.479	.85672	10.06954	.47526	864.1	1.340	.78419	9.21700	.59970
48	90	3.000	.375	.7389	933.8	1.461	.84758	9.96210	.49184	832.7	1.390	.81033	9.52432	.55646	661.3	.987	.60010	7.05330	.88624
49	90	4.000	.500	.9852	722.7	1.094	.65600	7.71039	.80003	631.9	1.023	.61899	7.27529	.85699					

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VI.- DATA[a] FOR 160° CONE; $M_\infty = 2.96$ - Concluded

(e) $\alpha = 20°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 3242.8 psf					Φ = 90.0°, p_t = 3240.7 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	974.8	1.532	.88461	10.39732	.42221	973.7	1.531	.88419	10.39233	.42305
2	0	.230	.025	.0493	970.0	1.524	.88027	10.34627	.43075	975.9	1.537	.88709	10.42646	.41728
3	0	.460	.050	.0985	973.2	1.529	.88316	10.38031	.42507	983.2	1.548	.89290	10.49471	.40557
4	0	.630	.075	.1478	973.2	1.529	.88316	10.38031	.42507	986.4	1.554	.89580	10.52884	.39962
5	0	.830	.100	.1971	970.0	1.524	.88027	10.34627	.43075	988.0	1.556	.89725	10.54591	.39662
6	0	1.000	.125	.2463	968.4	1.521	.87882	10.32926	.43357	986.4	1.554	.89580	10.52884	.39962
7	0	1.200	.150	.2956	963.6	1.513	.87448	10.27820	.44197	984.8	1.551	.89435	10.51178	.40260
8	0	1.400	.175	.3448	963.4	1.507	.87158	10.24417	.44750	983.2	1.548	.89290	10.49471	.40557
9	0	1.600	.200	.3941	954.0	1.496	.86579	10.17610	.45845	978.5	1.540	.88854	10.44352	.41437
10	0	1.830	.225	.4434	947.6	1.485	.86000	10.10804	.46923	975.9	1.537	.88709	10.42646	.41728
11	0	2.030	.250	.4926	941.3	1.474	.85421	10.03997	.47986	972.1	1.529	.88273	10.37526	.42591
12	0	2.230	.275	.5419	933.3	1.460	.84697	9.95488	.49295	965.7	1.517	.87693	10.30700	.43724
13	0	2.430	.300	.5912	925.3	1.446	.83973	9.86980	.50584	959.3	1.506	.87112	10.23875	.44838
14	0	2.600	.325	.6404	914.1	1.427	.82959	9.75068	.52358	951.3	1.492	.86386	10.15342	.46206
15	0	2.830	.350	.6897	901.4	1.405	.81801	9.61455	.54348	941.7	1.476	.85515	10.05104	.47814
16	0	3.000	.375	.7389	888.6	1.382	.80643	9.47841	.56301	930.5	1.456	.84498	9.93158	.49650
17	0	3.200	.400	.7882	869.5	1.349	.78905	9.27421	.59176	911.3	1.423	.82756	9.72681	.52710
18	0	3.400	.425	.8375	848.7	1.313	.77023	9.05299	.62226	892.1	1.390	.81014	9.52203	.55679
19	0	3.630	.450	.8867	821.6	1.266	.74562	8.76370	.66138	864.9	1.342	.78546	9.23194	.59763
20	0	3.800	.475	.9360	772.1	1.180	.70074	8.23618	.73126	813.8	1.253	.73900	8.68587	.67179
21	0	4.000	.500	.9852	702.0	1.058	.63704	7.48743	.82917	740.2	1.125	.67221	7.90090	.77514
22	180	.200	.025	.0493	992.9	1.564	.90109	10.59098	.38862	982.2	1.546	.89191	10.48307	.40758
23	180	.400	.050	.0985	1002.5	1.580	.90979	10.69330	.36999	986.9	1.555	.89626	10.53420	.39868
24	180	.530	.075	.1478	1008.9	1.592	.91560	10.76152	.35717	990.1	1.560	.89916	10.56829	.39266
25	180	.800	.100	.1971	1013.7	1.600	.91995	10.81269	.34731	991.7	1.563	.90061	10.58534	.38963
26	180	1.000	.125	.2463	1015.3	1.603	.92140	10.82974	.34398	991.7	1.563	.90061	10.58534	.38963
27	180	1.200	.150	.2956	1018.5	1.608	.92430	10.86385	.33723	990.1	1.560	.89916	10.56829	.39266
28	180	1.400	.175	.3448	1020.1	1.611	.92575	10.88091	.33382	990.1	1.560	.89916	10.56829	.39266
29	180	1.600	.200	.3941	1021.7	1.614	.92720	10.89796	.33037	986.9	1.555	.89626	10.53420	.39868
30	180	1.830	.225	.4434	1020.1	1.611	.92575	10.88091	.33382	983.8	1.549	.89336	10.50011	.40463
31	180	2.030	.250	.4926	1018.5	1.608	.92430	10.86385	.33723	979.0	1.541	.88900	10.44898	.41344
32	180	2.200	.275	.5419	1015.3	1.603	.92140	10.82974	.34398	974.2	1.532	.88465	10.39784	.42212
33	180	2.430	.300	.5912	1012.1	1.597	.91850	10.79563	.35062	967.8	1.521	.87885	10.32966	.43351
34	180	2.600	.325	.6404	1007.3	1.589	.91415	10.74447	.36041	959.8	1.507	.87160	10.24443	.44746
35	180	2.800	.350	.6897	999.3	1.575	.90689	10.65919	.37628	950.2	1.491	.86290	10.14215	.46384
36	180	3.000	.375	.7389	991.3	1.561	.89964	10.57392	.39166	939.0	1.471	.85275	10.02283	.48251
37	180	3.200	.400	.7882	976.9	1.536	.88658	10.42043	.41830	921.5	1.441	.83680	9.83533	.51101
38	180	3.400	.425	.8375	960.9	1.508	.87207	10.24988	.44658	902.3	1.407	.81939	9.63078	.54112
39	180	3.630	.450	.8867	932.2	1.458	.84595	9.94290	.49477	872.0	1.354	.79184	9.30692	.58719
40	180	3.800	.475	.9360	884.2	1.375	.80242	9.43126	.56971	822.5	1.268	.74688	8.77850	.65940
41	180	4.000	.500	.9852	791.4	1.213	.71826	8.44208	.70415	733.0	1.113	.66567	7.82395	.78520
42	270	1.030	.125	.2463	1060.1	1.681	.96203	11.30727	.23581	1066.8	1.694	.96377	11.38649	.21339
43	270	2.000	.250	.4926	1085.6	1.725	.98525	11.58015	.14588	1095.5	1.744	.99487	11.69331	.08572
44	270	3.000	.375	.7389	1082.4	1.720	.98234	11.54604	.15973	1098.7	1.749	.99777	11.72740	.05644
45	270	4.000	.500	.9852	908.2	1.416	.82418	9.68708	.53292	927.9	1.452	.84260	9.90352	.50075
46	90	1.000	.125	.2463	949.2	1.488	.86145	10.12505	.46655	948.1	1.487	.86096	10.11929	.46746
47	90	2.300	.250	.4926	909.3	1.418	.82525	9.69963	.53109	904.9	1.412	.82175	9.65855	.53709
48	90	3.000	.375	.7389	848.7	1.313	.77023	9.05299	.62226	844.2	1.306	.76658	9.01010	.62811
49	90	4.030	.500	.9852	650.9	.969	.59071	6.94289	.90087	649.1	.967	.58946	6.92822	.90281

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VII.- DATA[a] FOR 160° CONE; $M_\infty = 3.95$

(a) $\alpha = 0°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 5753.1 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	815.0	1.753	.97953	20.14241	.17214
2	0	.200	.025	.0493	814.4	1.749	.97761	20.10291	.18015
3	0	.400	.050	.0985	814.4	1.749	.97761	20.10291	.18015
4	0	.600	.075	.1478	812.8	1.745	.97569	20.06342	.18784
5	0	.800	.100	.1971	812.8	1.745	.97569	20.06342	.18784
6	0	1.000	.125	.2463	811.2	1.742	.97377	20.02392	.19524
7	0	1.200	.150	.2956	806.4	1.731	.96801	19.90544	.21603
8	0	1.400	.175	.3448	803.2	1.724	.96417	19.82645	.22892
9	0	1.600	.200	.3941	800.0	1.717	.96032	19.74746	.24119
10	0	1.800	.225	.4434	798.4	1.713	.95840	19.70796	.24711
11	0	2.000	.250	.4926	793.6	1.702	.95264	19.58948	.26418
12	0	2.200	.275	.5419	787.2	1.688	.94496	19.43150	.28554
13	0	2.400	.300	.5912	782.4	1.677	.93920	19.31302	.30070
14	0	2.600	.325	.6404	776.0	1.662	.93151	19.15504	.31997
15	0	2.800	.350	.6897	766.4	1.641	.91999	18.91807	.34722
16	0	3.000	.375	.7389	755.2	1.615	.90655	18.64160	.37702
17	0	3.200	.400	.7882	739.2	1.579	.88734	18.24665	.41678
18	0	3.400	.425	.8375	723.2	1.543	.86813	17.85170	.45404
19	0	3.600	.450	.8867	699.2	1.489	.83932	17.25928	.50655
20	0	3.800	.475	.9360	656.0	1.391	.78767	16.19292	.59435
21	0	4.000	.500	.9852	595.2	1.254	.71448	14.69211	.71001
22	180	.200	.025	.0493	821.5	1.765	.98612	20.27783	.14147
23	180	.400	.050	.0985	819.9	1.761	.98420	20.23838	.15102
24	180	.600	.075	.1478	815.7	1.754	.98036	20.15948	.16857
25	180	.800	.100	.1971	815.1	1.751	.97844	20.12003	.17672
26	180	1.000	.125	.2463	811.9	1.743	.97461	20.04113	.19205
27	180	1.200	.150	.2956	808.7	1.736	.97077	19.96222	.20631
28	180	1.400	.175	.3448	805.5	1.729	.96693	19.88332	.21971
29	180	1.600	.200	.3941	800.7	1.718	.96118	19.76497	.23852
30	180	1.800	.225	.4434	797.5	1.711	.95734	19.68607	.25034
31	180	2.000	.250	.4926	792.7	1.700	.95158	19.56771	.26721
32	180	2.200	.275	.5419	787.9	1.689	.94583	19.44936	.28320
33	180	2.400	.300	.5912	779.9	1.671	.93624	19.25211	.30825
34	180	2.600	.325	.6404	773.5	1.657	.92856	19.09430	.32713
35	180	2.800	.350	.6897	764.0	1.635	.91705	18.85760	.35390
36	180	3.000	.375	.7389	752.8	1.610	.90362	18.58144	.38327
37	180	3.200	.400	.7882	736.8	1.574	.88444	18.18693	.42255
38	180	3.400	.425	.8375	720.8	1.538	.86525	17.79242	.45946
39	180	3.600	.450	.8867	695.2	1.480	.83455	17.16120	.51494
40	180	3.800	.475	.9360	653.7	1.386	.78467	16.13547	.59891
41	180	4.000	.500	.9852	583.4	1.227	.70026	14.39963	.73200
42	270	1.000	.125	.2463	811.9	1.743	.97461	20.04113	.19205
43	270	2.000	.250	.4926	791.1	1.696	.94966	19.52826	.27263
44	270	3.000	.375	.7389	748.0	1.599	.89786	18.46308	.39535
45	270	4.000	.500	.9852	575.4	1.209	.69067	14.20237	.74678
46	90	1.000	.125	.2463	806.4	1.731	.96801	19.90544	.21603
47	90	2.000	.250	.4926	787.2	1.688	.94496	19.43150	.28554
48	90	3.000	.375	.7389	747.2	1.597	.89694	18.44413	.39726
49	90	4.000	.500	.9852	569.6	1.196	.68375	14.06019	.75742

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VII.- DATA[a] FOR 160° CONE; $M_\infty = 3.95$ - Continued

(b) $\alpha = 5°$

Orifice	e, deg	s, in.	s/D	s/s*	$\Phi = 0.0°$, $p_t = 5762.6$ psf					$\Phi = 22.5°$, $p_t = 5762.6$ psf					$\Phi = 45.0°$, $p_t = 5762.6$ psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	817.3	1.753	.97949	20.14166	.17230	817.4	1.753	.97963	20.14446	.17171	815.6	1.749	.97744	20.09945	.18084
2	0	.200	.025	.0493	812.5	1.742	.97374	20.02341	.19533	814.2	1.746	.97580	20.06562	.18741	814.0	1.745	.97553	20.06004	.18848
3	0	.400	.050	.0985	810.9	1.738	.97183	19.98400	.20246	811.0	1.738	.97196	19.98678	.20197	812.4	1.742	.97361	20.02063	.19584
4	0	.600	.075	.1478	807.7	1.731	.96799	19.90517	.21607	807.8	1.731	.96813	19.90793	.21561	809.2	1.734	.96978	19.94181	.20985
5	0	.800	.100	.1971	802.9	1.720	.96224	19.78692	.23513	804.6	1.724	.96429	19.82909	.22850	807.6	1.731	.96786	19.90240	.21654
6	0	1.000	.125	.2463	799.7	1.713	.95841	19.70809	.24709	803.0	1.720	.96238	19.78967	.23470	804.4	1.723	.96403	19.82358	.22938
7	0	1.200	.150	.2956	794.9	1.702	.95266	19.58984	.26413	796.6	1.706	.95471	19.63198	.25817	799.6	1.713	.95828	19.70534	.24750
8	0	1.400	.175	.3448	791.7	1.695	.94883	19.51100	.27497	793.4	1.699	.95087	19.55314	.26922	794.8	1.702	.95253	19.58711	.26451
9	0	1.600	.200	.3941	786.9	1.684	.94308	19.39276	.29057	788.6	1.688	.94512	19.43488	.28510	791.6	1.695	.94869	19.50829	.27534
10	0	1.800	.225	.4434	780.5	1.670	.93541	19.23509	.31033	783.8	1.677	.93937	19.31661	.30025	785.8	1.684	.94294	19.39006	.29092
11	0	2.000	.250	.4926	776.1	1.655	.92774	19.07743	.32910	777.4	1.663	.93170	19.15892	.31951	780.4	1.669	.93528	19.23242	.31066
12	0	2.200	.275	.5419	767.7	1.641	.92007	18.91976	.34703	771.0	1.648	.92404	19.00124	.33786	774.0	1.655	.92761	19.07477	.32940
13	0	2.400	.300	.5912	759.7	1.623	.91049	18.72268	.36847	763.0	1.630	.91445	18.80413	.35973	766.0	1.637	.91803	18.87772	.35149
14	0	2.600	.325	.6404	751.7	1.605	.90091	18.52560	.38900	753.4	1.608	.90295	18.56760	.38470	756.4	1.615	.90653	18.64126	.37706
15	0	2.800	.350	.6897	743.5	1.579	.88749	18.24969	.41648	742.2	1.583	.88953	18.29165	.41239	746.8	1.594	.89503	18.40479	.40120
16	0	3.000	.375	.7389	729.3	1.554	.87407	17.97377	.44275	732.6	1.562	.87803	18.05512	.43511	735.6	1.568	.88161	18.12892	.42811
17	0	3.200	.400	.7882	711.8	1.514	.85298	17.54020	.48208	715.1	1.522	.85694	17.62148	.47486	718.1	1.529	.86053	17.69540	.46824
18	0	3.400	.425	.8375	695.8	1.478	.83382	17.14603	.51623	699.1	1.486	.83777	17.22726	.50930	702.1	1.493	.84137	17.30129	.50294
19	0	3.600	.450	.8867	671.8	1.424	.80506	16.55479	.56530	675.1	1.432	.80901	16.63594	.55869	676.5	1.435	.81070	16.67072	.55584
20	0	3.800	.475	.9360	628.6	1.327	.75331	15.49096	.64924	631.9	1.334	.75725	15.57155	.64299	634.9	1.341	.76087	15.64604	.63723
21	0	4.000	.500	.9852	571.0	1.197	.68430	14.07157	.75657	574.3	1.204	.68823	14.15237	.75052	577.3	1.211	.69188	14.22726	.74492
22	180	.200	.025	.0493	826.0	1.772	.98989	20.35552	.12054	826.1	1.772	.99003	20.35835	.11972	825.9	1.772	.98976	20.35269	.12137
23	180	.400	.050	.0985	824.4	1.769	.98798	20.31615	.13155	826.1	1.772	.99003	20.35835	.11972	824.3	1.768	.98784	20.31332	.13231
24	180	.600	.075	.1478	824.4	1.769	.98798	20.31615	.13155	824.5	1.769	.98812	20.31897	.13079	824.3	1.768	.98784	20.31332	.13231
25	180	.800	.100	.1971	822.8	1.765	.98607	20.27677	.14173	824.5	1.769	.98812	20.31897	.13079	821.1	1.761	.98401	20.23459	.15191
26	180	1.000	.125	.2463	822.8	1.765	.98607	20.27677	.14173	821.3	1.762	.98429	20.24022	.15059	819.5	1.758	.98210	20.19522	.16085
27	180	1.200	.150	.2956	819.6	1.758	.98224	20.19803	.16022	819.7	1.758	.98237	20.20084	.15960	816.3	1.750	.97827	20.11649	.17744
28	180	1.400	.175	.3448	818.0	1.754	.98032	20.15866	.16874	815.5	1.751	.97854	20.12208	.17631	814.7	1.747	.97636	20.07712	.18520
29	180	1.600	.200	.3941	814.8	1.747	.97649	20.07991	.18466	814.9	1.747	.97663	20.08270	.18412	811.5	1.740	.97253	19.99838	.19989
30	180	1.800	.225	.4434	813.2	1.743	.97458	20.04054	.19216	811.7	1.740	.97280	20.00395	.19888	806.7	1.729	.96678	19.88028	.22021
31	180	2.000	.250	.4926	808.4	1.733	.96883	19.92242	.21316	806.9	1.729	.96705	19.88582	.21929	803.5	1.721	.96295	19.80155	.23285
32	180	2.200	.275	.5419	805.2	1.725	.96500	19.84368	.22617	803.7	1.722	.96322	19.80706	.23198	798.7	1.711	.95721	19.68345	.25073
33	180	2.400	.300	.5912	800.4	1.715	.95926	19.72556	.24449	798.9	1.711	.95748	19.68893	.24992	792.3	1.696	.94955	19.52598	.27294
34	180	2.600	.325	.6404	794.0	1.700	.95160	19.56807	.26716	792.6	1.697	.94982	19.53141	.27220	785.9	1.682	.94190	19.36851	.29368
35	180	2.800	.350	.6897	786.1	1.682	.94203	19.37121	.29334	784.6	1.679	.94024	19.33453	.29800	778.0	1.664	.93232	19.17168	.31799
36	180	3.000	.375	.7389	776.5	1.660	.93054	19.13497	.32235	775.0	1.657	.92875	19.09826	.32667	768.4	1.642	.92084	18.93548	.34528
37	180	3.200	.400	.7882	765.3	1.635	.91714	18.85937	.35371	760.6	1.625	.91152	18.74386	.36622	754.0	1.610	.90361	18.58118	.38330
38	180	3.400	.425	.8375	749.3	1.599	.89799	18.46564	.39509	744.6	1.589	.89237	18.35008	.40664	738.0	1.574	.88446	18.18751	.42250
39	180	3.600	.450	.8867	723.7	1.541	.86735	17.83569	.45551	722.2	1.538	.86556	17.79879	.45888	712.5	1.516	.85383	17.55764	.48054
40	180	3.800	.475	.9360	683.8	1.451	.81949	16.85138	.54096	680.7	1.444	.81577	16.77496	.54728	672.5	1.426	.80597	16.57346	.56378
41	180	4.000	.500	.9852	611.9	1.239	.73333	15.07962	.68068	608.8	1.232	.72960	15.00296	.68650	602.2	1.267	.72174	14.84132	.69874
42	270	1.000	.125	.2463	814.8	1.747	.97649	20.07991	.18466	818.1	1.754	.98046	20.16146	.16815	821.1	1.761	.98401	20.23459	.15191
43	270	2.000	.250	.4926	792.4	1.696	.94969	19.52870	.27257	798.9	1.711	.95748	19.68893	.24992	805.1	1.725	.96487	19.84092	.22661
44	270	3.000	.375	.7389	750.9	1.633	.89990	18.50502	.39110	759.0	1.621	.90960	18.70448	.37041	768.4	1.642	.92084	18.93548	.34528
45	270	4.000	.500	.9852	576.8	1.210	.69120	14.21343	.74595	584.8	1.228	.70087	14.41229	.73105	597.4	1.257	.71599	14.72322	.70766
46	90	1.000	.125	.2463	807.7	1.731	.96799	19.90517	.21607	804.6	1.724	.96429	19.82909	.22850	802.8	1.720	.96211	19.78417	.23556
47	90	2.000	.250	.4926	788.5	1.688	.94499	19.43217	.28545	783.8	1.677	.93937	19.31661	.30025	780.4	1.569	.93528	19.23242	.31066
48	90	3.000	.375	.7389	745.3	1.590	.89324	18.36794	.40487	740.6	1.580	.88761	18.25223	.41623	735.6	1.568	.88161	18.12892	.42811
49	90	4.000	.500	.9852	569.4	1.193	.68239	14.03216	.75951	564.7	1.183	.67673	13.91584	.76820	559.7	1.171	.67079	13.79374	.77732

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VII.- DATA[a] FOR 160° CONE; M_∞ = 3.95 - Continued

(b) α = 5° - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 5762.6 psf					Φ = 90.0°, p_t = 5762.6 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	817.5	1.753	.97970	20.14587	.17142	818.7	1.756	.98121	20.17687	.16485
2	0	.200	.025	.0493	815.9	1.749	.97778	20.10644	.17945	818.7	1.756	.98121	20.17687	.16485
3	0	.400	.050	.0985	815.9	1.749	.97778	20.10644	.17945	817.1	1.752	.97929	20.13746	.17316
4	0	.600	.075	.1478	812.7	1.742	.97395	20.02759	.19456	815.5	1.749	.97737	20.09805	.18111
5	0	.800	.100	.1971	811.1	1.739	.97203	19.98817	.20172	812.3	1.741	.97354	20.01924	.19610
6	0	1.000	.125	.2463	807.9	1.731	.96820	19.90932	.21538	810.7	1.738	.97162	19.97983	.20320
7	0	1.200	.150	.2956	803.1	1.721	.96244	19.79105	.23449	806.0	1.727	.96588	19.86161	.22327
8	0	1.400	.175	.3448	799.9	1.713	.95861	19.71220	.24648	802.8	1.720	.96204	19.78279	.23577
9	0	1.600	.200	.3941	795.1	1.702	.95286	19.59397	.26356	799.6	1.713	.95821	19.70397	.24770
10	0	1.800	.225	.4434	790.3	1.692	.94711	19.47565	.27971	794.8	1.702	.95246	19.58575	.26470
11	0	2.000	.250	.4926	783.9	1.677	.93944	19.31795	.30008	788.4	1.687	.94479	19.42812	.28598
12	0	2.200	.275	.5419	777.5	1.663	.93177	19.16026	.31935	782.0	1.673	.93713	19.27049	.30599
13	0	2.400	.300	.5912	771.1	1.648	.92410	19.00256	.33771	775.6	1.658	.92946	19.11285	.32496
14	0	2.600	.325	.6404	761.5	1.627	.91260	18.76601	.36384	767.6	1.640	.91988	18.91581	.34747
15	0	2.800	.350	.6897	751.9	1.605	.90109	18.52947	.38861	758.0	1.619	.90838	18.67937	.37306
16	0	3.000	.375	.7389	740.7	1.580	.88767	18.25349	.41611	746.8	1.593	.89497	18.40351	.40133
17	0	3.200	.400	.7882	723.1	1.540	.86658	17.81983	.45696	730.8	1.557	.87580	18.00943	.43941
18	0	3.400	.425	.8375	707.1	1.504	.84741	17.42558	.49215	713.2	1.518	.85472	17.57594	.47891
19	0	3.600	.450	.8867	693.1	1.450	.81865	16.83422	.54238	690.8	1.467	.82789	17.02423	.52653
20	0	3.800	.475	.9360	641.5	1.356	.76880	15.80918	.62455	647.6	1.370	.77615	15.96022	.61273
21	0	4.000	.500	.9852	582.3	1.222	.69787	14.35048	.73568	588.5	1.236	.70524	14.50212	.72430
22	180	.200	.025	.0493	824.6	1.769	.98819	20.32038	.13041	822.6	1.765	.98586	20.27254	.14278
23	180	.400	.050	.0985	823.0	1.765	.98627	20.28100	.14067	821.0	1.761	.98395	20.23318	.15223
24	180	.600	.075	.1478	821.4	1.762	.98436	20.24162	.15025	819.4	1.757	.98203	20.19381	.16116
25	180	.800	.100	.1971	819.8	1.758	.98244	20.20224	.15929	816.2	1.750	.97820	20.11509	.17772
26	180	1.000	.125	.2463	815.6	1.751	.97861	20.12348	.17602	814.6	1.747	.97629	20.07572	.18547
27	180	1.200	.150	.2956	815.0	1.747	.97670	20.08410	.18385	811.4	1.739	.97246	19.99699	.20014
28	180	1.400	.175	.3448	811.8	1.740	.97287	20.00534	.19863	808.7	1.729	.96672	19.87890	.22044
29	180	1.600	.200	.3941	807.0	1.729	.96712	19.88720	.21907	803.5	1.721	.96289	19.80017	.23306
30	180	1.800	.225	.4434	803.8	1.722	.96329	19.80844	.23177	798.7	1.711	.95714	19.68208	.25093
31	180	2.000	.250	.4926	799.0	1.711	.95754	19.69029	.24972	793.9	1.700	.95140	19.56399	.26773
32	180	2.200	.275	.5419	792.6	1.697	.94988	19.53277	.27202	787.5	1.685	.94374	19.40653	.28879
33	180	2.400	.300	.5912	786.2	1.682	.94222	19.37525	.29282	781.1	1.671	.93609	19.24907	.30862
34	180	2.600	.325	.6404	779.8	1.668	.93456	19.21773	.31244	773.1	1.653	.92652	19.05225	.33201
35	180	2.800	.350	.6897	770.2	1.646	.92307	18.98144	.34010	763.5	1.631	.91503	18.81607	.35844
36	180	3.000	.375	.7389	760.6	1.625	.91158	18.74516	.36608	752.3	1.606	.90163	18.54052	.38748
37	180	3.200	.400	.7882	744.7	1.589	.89243	18.35135	.40651	736.4	1.570	.88249	18.14698	.42640
38	180	3.400	.425	.8375	728.7	1.553	.87328	17.95755	.44426	720.4	1.534	.86334	17.75324	.46302
39	180	3.600	.450	.8867	704.7	1.499	.84455	17.36684	.49726	696.8	1.476	.83272	17.12341	.51815
40	180	3.800	.475	.9360	663.2	1.405	.79476	16.34294	.58238	654.9	1.386	.78486	16.13931	.59861
41	180	4.000	.500	.9852	591.3	1.243	.70858	14.57082	.71914	583.0	1.224	.69872	14.36792	.73438
42	270	1.000	.125	.2463	823.0	1.765	.98627	20.28100	.14067	822.6	1.765	.98586	20.27254	.14278
43	270	2.000	.250	.4926	810.2	1.737	.97095	19.96596	.20565	811.4	1.739	.97246	19.99699	.20014
44	270	3.000	.375	.7389	776.6	1.661	.93073	19.13897	.32188	777.9	1.664	.93226	19.17035	.31815
45	270	4.000	.500	.9852	637.2	1.279	.72773	14.96462	.68941	638.6	1.282	.72934	14.99775	.68689
46	90	1.000	.125	.2463	799.9	1.713	.95861	19.71220	.24648	799.6	1.713	.95821	19.70397	.24770
47	90	2.000	.250	.4926	775.9	1.659	.92985	19.12083	.32402	775.6	1.658	.92946	19.11285	.32496
48	90	3.000	.375	.7389	731.1	1.558	.87617	18.01695	.43871	729.2	1.554	.87389	17.97002	.44310
49	90	4.000	.500	.9852	555.1	1.161	.66528	13.68026	.78580	553.3	1.157	.66308	13.63515	.78916

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VII.- DATA[a] FOR 160° CONE; $M_\infty = 3.95$ - Continued

(c) $\alpha = 10°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 5762.6 psf					Φ = 22.5°, p_t = 5762.6 psf					Φ = 45.0°, p_t = 5762.6 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	799.7	1.713	.95841	19.70809	.24709	799.7	1.713	.95834	19.70671	.24733	799.9	1.713	.95868	19.71357	.24628
2	0	.230	.025	.0493	793.3	1.698	.95074	19.55042	.26960	793.3	1.698	.95068	19.54906	.26979	795.1	1.703	.95292	19.59529	.26337
3	0	.400	.050	.0985	790.1	1.691	.94691	19.47159	.28025	791.7	1.695	.94876	19.50965	.27515	791.9	1.695	.94909	19.51643	.27426
4	0	.630	.075	.1478	785.3	1.680	.94116	19.35334	.29562	786.9	1.684	.94301	19.39141	.29075	787.3	1.692	.94717	19.47701	.27953
5	0	.930	.100	.1971	782.1	1.673	.93732	19.27451	.30549	783.7	1.677	.93918	19.31258	.30076	787.1	1.685	.94334	19.39815	.28988
6	0	1.300	.125	.2463	777.3	1.662	.93157	19.15626	.31983	778.9	1.666	.93343	19.19434	.31527	782.3	1.674	.93759	19.27987	.30483
7	0	1.230	.150	.2956	770.9	1.648	.92391	18.99859	.33816	772.5	1.651	.92576	19.03669	.33380	777.5	1.663	.93183	19.16159	.31919
8	0	1.430	.175	.3448	766.1	1.637	.91816	18.88035	.35140	769.3	1.644	.92193	18.95786	.34277	772.7	1.652	.92608	19.04331	.33304
9	0	1.630	.200	.3941	759.7	1.623	.91049	18.72268	.36847	762.9	1.630	.91426	18.80021	.36018	767.9	1.641	.92033	18.92503	.34644
10	0	1.830	.225	.4434	754.9	1.612	.90474	18.60443	.38089	756.5	1.615	.90659	18.64255	.37692	763.1	1.630	.91458	18.80674	.35945
11	0	2.300	.250	.4926	748.5	1.597	.89707	18.44677	.39699	750.1	1.601	.89893	18.48490	.39314	755.1	1.612	.90499	18.60961	.38035
12	0	2.230	.275	.5419	738.9	1.576	.88557	18.21027	.42030	742.1	1.583	.88934	18.28783	.41276	748.7	1.598	.89732	18.45190	.39648
13	0	2.400	.300	.5912	730.9	1.558	.87599	18.01319	.43906	734.1	1.565	.87976	18.09076	.43174	740.7	1.580	.88773	18.25476	.41599
14	0	2.630	.325	.6404	721.3	1.536	.86449	17.77669	.46089	724.5	1.543	.86826	17.85428	.45380	732.7	1.562	.87815	18.05763	.43488
15	0	2.800	.350	.6897	711.8	1.514	.85298	17.54020	.48208	714.9	1.522	.85676	17.61780	.47519	723.1	1.540	.86664	17.82107	.45684
16	0	3.030	.375	.7389	700.6	1.489	.83957	17.26428	.50612	703.7	1.496	.84334	17.34191	.49943	712.0	1.515	.85322	17.54508	.48165
17	0	3.200	.400	.7882	683.0	1.449	.81848	16.83071	.54267	686.1	1.457	.82226	16.90836	.53622	694.4	1.475	.83213	17.11138	.51917
18	0	3.400	.425	.8375	667.0	1.413	.79931	16.43654	.57686	670.1	1.420	.80309	16.51423	.56858	678.4	1.439	.81296	16.71711	.55204
19	0	3.630	.450	.8867	643.0	1.359	.77056	15.84530	.62173	646.1	1.366	.77434	15.92303	.61565	656.0	1.389	.78611	16.16513	.59656
20	0	3.800	.475	.9360	603.0	1.269	.72264	14.85990	.69734	606.1	1.276	.72642	14.93769	.69145	614.4	1.295	.73626	15.14002	.67608
21	0	4.030	.500	.9852	548.6	1.146	.65747	13.51975	.79778	551.8	1.153	.66126	13.59763	.79196	558.4	1.168	.66916	13.76007	.77984
22	180	.200	.025	.0493	815.4	1.751	.97841	20.11928	.17687	816.4	1.750	.97834	20.11788	.17715	815.0	1.747	.97676	20.08550	.18358
23	180	.430	.050	.0985	821.2	1.761	.98415	20.23740	.15125	821.1	1.761	.98408	20.23599	.15158	816.6	1.751	.97868	20.12488	.17574
24	180	.500	.075	.1478	824.4	1.769	.98798	20.31615	.13155	824.3	1.768	.98791	20.31473	.13193	819.8	1.758	.98251	20.20365	.15897
25	180	.300	.100	.1971	826.0	1.772	.98989	20.35552	.12054	824.3	1.768	.98791	20.31473	.13193	819.8	1.758	.98251	20.20365	.15897
26	180	1.000	.125	.2463	827.6	1.776	.99181	20.39489	.10846	825.9	1.772	.98983	20.35410	.12096	819.8	1.758	.98251	20.20365	.15897
27	180	1.200	.150	.2956	827.6	1.776	.99181	20.39489	.10846	827.5	1.776	.99174	20.39347	.10892	819.8	1.758	.98251	20.20365	.15897
28	180	1.400	.175	.3448	829.2	1.779	.99372	20.43426	.09488	827.5	1.776	.99174	20.39347	.10892	819.8	1.758	.98251	20.20365	.15897
29	180	1.600	.200	.3941	827.6	1.776	.99181	20.39489	.10846	825.9	1.772	.98983	20.35410	.12096	816.6	1.751	.97868	20.12488	.17574
30	180	1.300	.225	.4434	827.6	1.776	.99181	20.39489	.10846	824.3	1.768	.98791	20.31473	.13193	815.0	1.747	.97676	20.08550	.18358
31	180	2.000	.250	.4926	825.0	1.772	.98989	20.35552	.12054	822.7	1.765	.98600	20.27536	.14208	811.8	1.740	.97293	20.00673	.19838
32	180	2.200	.275	.5419	822.8	1.765	.98607	20.27677	.14173	821.1	1.761	.98408	20.23599	.15158	808.6	1.733	.96910	19.92796	.21222
33	180	2.400	.300	.5912	819.6	1.758	.98224	20.19803	.16022	816.4	1.750	.97834	20.11788	.17715	803.8	1.722	.96336	19.80981	.23155
34	180	2.600	.325	.6404	816.4	1.751	.97841	20.11928	.17687	811.6	1.740	.97259	19.99978	.19964	799.1	1.711	.95761	19.69166	.24952
35	180	2.800	.350	.6897	813.0	1.736	.97075	19.96179	.20638	805.2	1.725	.96494	19.84230	.22639	792.7	1.697	.94995	19.53413	.27183
36	180	3.000	.375	.7389	802.0	1.718	.96117	19.76493	.23852	797.2	1.707	.95536	19.64545	.25624	733.1	1.675	.93846	19.29783	.30260
37	180	3.230	.400	.7882	790.8	1.693	.94777	19.48933	.27789	786.0	1.682	.94196	19.36986	.29351	770.3	1.647	.92314	18.98276	.33995
38	180	3.400	.425	.8375	776.5	1.660	.93054	19.13497	.32235	773.2	1.653	.92665	19.05490	.33170	755.9	1.614	.90590	18.62831	.37841
39	180	3.600	.450	.8867	752.5	1.606	.90182	18.56439	.38708	749.3	1.599	.89793	18.46436	.39522	730.3	1.556	.87526	17.99818	.44047
40	180	3.800	.475	.9360	715.8	1.523	.85778	17.63882	.47331	709.3	1.509	.85006	17.48012	.48737	692.0	1.470	.82929	17.05298	.52410
41	180	4.000	.500	.9852	643.9	1.361	.77162	15.86707	.62003	637.4	1.347	.76391	15.70849	.63239	618.5	1.304	.74119	15.24135	.66835
42	270	1.000	.125	.2463	800.4	1.715	.95926	19.72556	.24449	811.6	1.740	.97259	19.99978	.19964	819.8	1.758	.98251	20.20365	.15897
43	270	2.000	.250	.4926	782.9	1.675	.93820	19.29246	.30327	798.8	1.711	.95728	19.68482	.25053	811.8	1.740	.97293	20.00673	.19838
44	270	3.000	.375	.7389	744.5	1.588	.89225	18.34753	.40689	763.6	1.631	.91516	18.81869	.35815	733.1	1.675	.93846	19.29783	.30260
45	270	4.000	.500	.9852	573.6	1.203	.68737	14.13468	.75185	592.7	1.246	.71030	14.60614	.71648	615.3	1.297	.73736	15.16258	.67436
46	90	1.000	.125	.2463	794.9	1.702	.95266	19.58984	.26413	786.9	1.684	.94301	19.39141	.29075	742.3	1.674	.93759	19.27987	.30483
47	90	2.000	.250	.4926	777.3	1.662	.93157	19.15626	.31983	766.1	1.637	.91809	18.87903	.35155	756.7	1.616	.90691	18.64904	.37624
48	90	3.000	.375	.7389	738.9	1.576	.88557	18.21027	.42030	722.9	1.540	.86634	17.81487	.45741	712.0	1.515	.85322	17.54508	.48165
49	90	4.000	.500	.9852	564.6	1.182	.67664	13.91391	.76835	551.8	1.153	.66126	13.59763	.79196	540.8	1.129	.64807	13.32637	.81222

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VII.- DATA[a] FOR 160° CONE; $M_\infty = 3.95$ - Continued

(c) $\alpha = 10°$ - Concluded

Orifice	e, deg	s, in.	s/D	s/s*	$\Phi = 67.5°$, $p_t = 5762.6$ psf					$\Phi = 90.0°$, $p_t = 5762.6$ psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	801.6	1.717	.96066	19.75437	.24013	800.0	1.714	.95874	19.71494	.24607
2	0	.200	.025	.0493	798.4	1.710	.95683	19.67551	.25189	800.0	1.714	.95874	19.71494	.24607
3	0	.400	.050	.0985	796.8	1.706	.95491	19.63608	.25759	800.0	1.714	.95874	19.71494	.24607
4	0	.600	.075	.1478	795.2	1.703	.95299	19.59665	.26318	800.0	1.714	.95874	19.71494	.24607
5	0	.800	.100	.1971	792.0	1.695	.94916	19.51779	.27405	798.4	1.710	.95593	19.67551	.25189
6	0	1.000	.125	.2463	788.8	1.688	.94532	19.43893	.28457	796.8	1.706	.95491	19.63608	.25759
7	0	1.200	.150	.2956	784.0	1.677	.93957	19.32064	.29975	793.6	1.699	.95107	19.55722	.26866
8	0	1.400	.175	.3448	780.8	1.670	.93573	19.24178	.30951	792.0	1.695	.94916	19.51779	.27405
9	0	1.600	.200	.3941	776.0	1.659	.92998	19.12349	.32371	787.2	1.685	.94340	19.39950	.28970
10	0	1.800	.225	.4434	771.2	1.649	.92423	19.00520	.33741	784.0	1.677	.93957	19.32064	.29975
11	0	2.000	.250	.4926	766.4	1.638	.91848	18.88691	.35068	779.2	1.667	.93382	19.20235	.31430
12	0	2.200	.275	.5419	765.0	1.623	.91081	18.72919	.36778	772.8	1.652	.92615	19.04463	.33289
13	0	2.400	.300	.5912	759.6	1.609	.90314	18.57147	.38430	769.0	1.641	.92039	18.92634	.34630
14	0	2.600	.325	.6404	744.0	1.587	.89163	18.33489	.40814	760.0	1.623	.91081	18.72919	.36778
15	0	2.800	.350	.6897	734.4	1.566	.88013	18.09831	.43103	750.4	1.602	.89930	18.49261	.39236
16	0	3.000	.375	.7389	724.8	1.544	.86962	17.86173	.45312	739.2	1.576	.88588	18.21660	.41969
17	0	3.200	.400	.7882	708.8	1.508	.84945	17.46744	.48849	723.2	1.540	.86670	17.82230	.45673
18	0	3.400	.425	.8375	691.2	1.468	.82835	17.03371	.52573	707.2	1.504	.84753	17.42801	.49194
19	0	3.600	.450	.8867	668.8	1.418	.80151	16.48169	.57122	684.8	1.454	.82068	16.87599	.53892
20	0	3.800	.475	.9360	627.2	1.324	.75165	15.45651	.65186	643.2	1.360	.77083	15.85081	.62130
21	0	4.000	.500	.9852	548.0	1.190	.68071	13.99761	.76209	584.0	1.226	.69988	14.39191	.73258
22	180	.200	.025	.0493	811.9	1.740	.97300	20.00812	.19813	808.7	1.733	.96917	19.92935	.21198
23	180	.400	.050	.0985	811.9	1.740	.97300	20.00812	.19813	807.1	1.730	.96725	19.88996	.21861
24	180	.600	.075	.1478	811.9	1.740	.97300	20.00812	.19813	807.1	1.730	.96725	19.88996	.21861
25	180	.800	.100	.1971	811.9	1.740	.97300	20.00812	.19813	803.9	1.722	.96342	19.81119	.23133
26	180	1.000	.125	.2463	811.9	1.740	.97300	20.00812	.19813	800.7	1.715	.95959	19.73242	.24346
27	180	1.200	.150	.2956	808.7	1.733	.96917	19.92935	.21198	799.1	1.712	.95768	19.69303	.24932
28	180	1.400	.175	.3448	808.7	1.733	.96917	19.92935	.21198	795.9	1.704	.95385	19.61426	.26069
29	180	1.600	.200	.3941	805.5	1.726	.96534	19.85058	.22505	792.7	1.697	.95002	19.53549	.27164
30	180	1.800	.225	.4434	802.3	1.719	.96151	19.77181	.23747	789.5	1.690	.94619	19.45672	.28223
31	180	2.000	.250	.4926	799.1	1.712	.95768	19.69303	.24932	784.7	1.679	.94044	19.33856	.29749
32	180	2.200	.275	.5419	794.3	1.701	.95193	19.57487	.26622	778.3	1.665	.93278	19.18101	.31687
33	180	2.400	.300	.5912	789.5	1.690	.94619	19.45672	.28223	771.9	1.650	.92512	19.02347	.33532
34	180	2.600	.325	.6404	783.1	1.675	.93852	19.29917	.30243	765.5	1.636	.91746	18.86593	.35299
35	180	2.800	.350	.6897	773.5	1.654	.92703	19.06286	.33079	756.0	1.614	.90596	18.62961	.37827
36	180	3.000	.375	.7389	765.5	1.636	.91746	18.86593	.35299	744.8	1.589	.89256	18.35391	.40626
37	180	3.200	.400	.7882	751.2	1.603	.90022	18.51145	.39045	732.0	1.560	.87723	18.03882	.43665
38	180	3.400	.425	.8375	735.2	1.567	.88106	18.11759	.42919	714.4	1.520	.85616	17.60557	.47628
39	180	3.600	.450	.8867	711.2	1.513	.85233	17.52680	.48326	688.8	1.463	.82552	16.97539	.53062
40	180	3.800	.475	.9360	671.3	1.423	.80445	16.54215	.56632	648.9	1.373	.77763	15.99074	.61033
41	180	4.000	.500	.9852	599.3	1.261	.71826	14.76977	.70415	578.6	1.214	.69336	14.25776	.74263
42	270	1.000	.125	.2463	826.3	1.773	.99024	20.36260	.11846	929.5	1.780	.99407	20.44137	.09222
43	270	2.000	.250	.4926	824.7	1.769	.98832	20.32321	.12964	827.9	1.776	.99215	20.40198	.10614
44	270	3.000	.375	.7389	797.5	1.708	.95576	19.65365	.25506	803.9	1.722	.96342	19.81119	.23133
45	270	4.000	.500	.9852	634.5	1.360	.76040	15.63627	.63799	640.9	1.355	.76806	15.79381	.62575
46	90	1.000	.125	.2463	779.2	1.667	.93382	19.20235	.31430	777.6	1.663	.93190	19.16292	.31903
47	90	2.000	.250	.4926	750.4	1.602	.89930	18.49261	.39236	768.8	1.598	.89738	18.45318	.39635
48	90	3.000	.375	.7389	704.0	1.497	.84369	17.34915	.49880	700.8	1.490	.83986	17.27029	.50561
49	90	4.000	.500	.9852	534.4	1.114	.64044	13.16958	.82393	531.2	1.107	.63661	13.09072	.82983

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VII.- DATA[a] FOR 160° CONE; $M_\infty = 3.95$ - Continued

(d) $\alpha = 15°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 5762.6 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	771.3	1.649	.92436	19.00784	.33710
2	0	.200	.025	.0493	763.3	1.631	.91477	18.81067	.35902
3	0	.400	.050	.0985	761.7	1.627	.91285	18.77123	.36328
4	0	.600	.075	.1478	758.5	1.620	.90901	18.69236	.37169
5	0	.800	.100	.1971	755.3	1.613	.90518	18.61349	.37995
6	0	1.000	.125	.2463	748.9	1.598	.89751	18.45575	.39609
7	0	1.200	.150	.2956	744.1	1.587	.89175	18.33744	.40789
8	0	1.400	.175	.3448	737.7	1.573	.88408	18.17970	.42325
9	0	1.600	.200	.3941	731.3	1.559	.87641	18.02196	.43824
10	0	1.800	.225	.4434	724.9	1.544	.86874	17.86422	.45289
11	0	2.000	.250	.4926	716.9	1.526	.85915	17.66704	.47079
12	0	2.200	.275	.5419	710.5	1.512	.85148	17.50930	.48481
13	0	2.400	.300	.5912	702.5	1.494	.84189	17.31212	.50200
14	0	2.600	.325	.6404	694.5	1.475	.83230	17.11495	.51887
15	0	2.800	.350	.6897	683.3	1.450	.81888	16.83890	.54200
16	0	3.000	.375	.7389	673.7	1.429	.80737	16.60229	.56143
17	0	3.200	.400	.7882	657.7	1.392	.78820	16.20793	.59316
18	0	3.400	.425	.8375	643.3	1.360	.77094	15.85301	.62113
19	0	3.600	.450	.8867	620.9	1.309	.74409	15.30092	.66380
20	0	3.800	.475	.9360	582.5	1.223	.69806	14.35447	.73538
21	0	4.000	.500	.9852	531.3	1.107	.63669	13.09254	.82970
22	180	.200	.025	.0493	794.4	1.701	.95206	19.57760	.26584
23	180	.400	.050	.0985	805.6	1.726	.96547	19.85334	.22461
24	180	.600	.075	.1478	812.0	1.741	.97314	20.01090	.19762
25	180	.800	.100	.1971	816.8	1.751	.97888	20.12908	.17488
26	180	1.000	.125	.2463	820.0	1.759	.98271	20.20786	.15803
27	180	1.200	.150	.2956	823.2	1.766	.98655	20.28664	.13925
28	180	1.400	.175	.3448	824.8	1.769	.98846	20.32604	.12887
29	180	1.600	.200	.3941	826.4	1.773	.99038	20.36543	.11762
30	180	1.800	.225	.4434	828.0	1.777	.99229	20.40482	.10520
31	180	2.000	.250	.4926	828.0	1.777	.99229	20.40482	.10520
32	180	2.200	.275	.5419	828.0	1.777	.99229	20.40482	.10520
33	180	2.400	.300	.5912	828.0	1.777	.99229	20.40482	.10520
34	180	2.600	.325	.6404	826.4	1.773	.99038	20.36543	.11762
35	180	2.800	.350	.6897	824.8	1.769	.98846	20.32604	.12887
36	180	3.000	.375	.7389	821.6	1.762	.98463	20.24725	.14892
37	180	3.200	.400	.7882	813.6	1.744	.97505	20.05030	.19033
38	180	3.400	.425	.8375	802.4	1.719	.96164	19.77455	.23704
39	180	3.600	.450	.8867	784.8	1.679	.94057	19.34125	.29715
40	180	3.800	.475	.9360	751.3	1.604	.90034	18.51402	.39018
41	180	4.000	.500	.9852	679.3	1.441	.81414	16.74141	.55004
42	270	1.000	.125	.2463	778.4	1.665	.93291	19.18368	.31655
43	270	2.000	.250	.4926	765.7	1.636	.91758	18.86855	.35270
44	270	3.000	.375	.7389	732.1	1.560	.87735	18.04133	.43641
45	270	4.000	.500	.9852	565.8	1.185	.67813	13.94461	.76606
46	90	1.000	.125	.2463	771.3	1.649	.92436	19.00784	.33710
47	90	2.000	.250	.4926	758.5	1.620	.90901	18.69236	.37169
48	90	3.000	.375	.7389	723.3	1.540	.86682	17.82478	.45650
49	90	4.000	.500	.9852	555.3	1.161	.66546	13.68407	.78551

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VII.- DATA[a] FOR 160° CONE; $M_\infty = 3.95$ - Continued

(e) $\alpha = 20°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 5762.6 psf					Φ = 22.5°, p_t = 5762.6 psf					Φ = 45.0°, p_t = 5762.6 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	731.1	1.558	.87623	18.01820	.43859	731.6	1.559	.87681	18.03004	.43748	730.9	1.558	.87599	18.01319	.43906
2	0	.200	.025	.0493	721.5	1.537	.86473	17.78164	.46044	723.6	1.541	.86723	17.83321	.45573	724.5	1.543	.86832	17.85553	.45369
3	0	.400	.050	.0985	723.1	1.540	.86664	17.82107	.45684	723.6	1.541	.86723	17.83321	.45573	726.1	1.547	.87024	17.89494	.45006
4	0	.600	.075	.1478	723.1	1.540	.86664	17.82107	.45684	723.6	1.541	.86723	17.83321	.45573	725.1	1.547	.87024	17.89494	.45006
5	0	.800	.100	.1971	718.4	1.529	.86089	17.70278	.46758	720.4	1.534	.86340	17.75447	.46291	722.9	1.540	.86640	17.81611	.45730
6	0	1.000	.125	.2463	713.6	1.518	.85514	17.58450	.47815	715.7	1.523	.85766	17.63637	.47353	719.7	1.532	.86257	17.73728	.46446
7	0	1.200	.150	.2956	708.8	1.508	.84939	17.46622	.48859	710.9	1.512	.85192	17.51827	.48402	715.0	1.522	.85682	17.61903	.47508
8	0	1.400	.175	.3448	704.0	1.497	.84364	17.34794	.49890	706.1	1.502	.84618	17.40017	.49437	711.8	1.514	.85298	17.54020	.48208
9	0	1.600	.200	.3941	697.6	1.492	.83597	17.19023	.51246	701.3	1.491	.84043	17.28207	.50459	707.0	1.504	.84723	17.42195	.49247
10	0	1.800	.225	.4434	692.8	1.472	.83021	17.07195	.52250	696.9	1.476	.83277	17.12460	.51805	702.2	1.493	.84148	17.30370	.50273
11	0	2.000	.250	.4926	686.4	1.457	.82254	16.91424	.53573	688.5	1.462	.82512	16.96713	.53132	695.8	1.478	.83382	17.14603	.51623
12	0	2.200	.275	.5419	680.0	1.443	.81487	16.75653	.54880	682.1	1.448	.81746	16.80967	.54442	689.4	1.464	.82615	16.98837	.52954
13	0	2.400	.300	.5912	672.0	1.425	.80529	16.55940	.56492	674.1	1.430	.80789	16.61283	.56057	683.0	1.449	.81848	16.83071	.54267
14	0	2.600	.325	.6404	664.0	1.407	.79570	16.36226	.58083	667.7	1.415	.80023	16.45536	.57334	675.0	1.431	.80890	16.63362	.55888
15	0	2.800	.350	.6897	652.8	1.381	.78228	16.08627	.60280	656.5	1.390	.78683	16.17980	.59540	667.0	1.413	.79931	16.43654	.57486
16	0	3.000	.375	.7389	644.8	1.363	.77269	15.88914	.61831	648.6	1.372	.77726	15.98296	.61095	655.8	1.388	.78590	16.16063	.59692
17	0	3.200	.400	.7882	630.4	1.331	.75544	15.53429	.64587	632.6	1.336	.75811	15.58929	.64162	643.0	1.359	.77056	15.84530	.62173
18	0	3.400	.425	.8375	617.6	1.302	.74010	15.21887	.67007	619.8	1.307	.74280	15.27436	.66583	627.0	1.323	.75139	15.45114	.65227
19	0	3.600	.450	.8867	596.8	1.255	.71517	14.70632	.70893	599.0	1.260	.71791	14.76259	.70469	606.2	1.276	.72647	14.93873	.69137
20	0	3.800	.475	.9360	561.6	1.176	.67299	13.83892	.77395	563.9	1.181	.67579	13.89652	.76965	571.0	1.197	.68430	14.07157	.75657
21	0	4.000	.500	.9852	515.2	1.071	.61739	12.69554	.85945	516.0	1.073	.61836	12.71551	.85795	519.8	1.081	.62297	12.81026	.85084
22	180	.200	.025	.0493	763.9	1.632	.91548	18.82523	.35744	763.6	1.631	.91509	18.81738	.35829	757.3	1.617	.90756	18.66251	.37483
23	180	.400	.050	.0985	783.1	1.675	.93846	19.29783	.30260	781.2	1.671	.93615	19.25041	.30846	771.7	1.650	.92479	19.01686	.33608
24	180	.600	.075	.1478	792.7	1.697	.94995	19.53413	.27183	789.1	1.689	.94573	19.44725	.28348	778.1	1.664	.93245	19.17435	.31767
25	180	.800	.100	.1971	800.7	1.715	.95953	19.73105	.24366	797.1	1.707	.95530	19.64408	.25644	784.5	1.678	.94011	19.33184	.29836
26	180	1.000	.125	.2463	807.0	1.729	.96719	19.88858	.21884	801.9	1.718	.96134	19.76218	.23894	789.2	1.689	.94586	19.44995	.28312
27	180	1.200	.150	.2956	811.8	1.740	.97293	20.00673	.19838	806.7	1.729	.96678	19.88028	.22021	792.4	1.696	.94969	19.52870	.27257
28	180	1.400	.175	.3448	815.6	1.751	.97868	20.12488	.17574	811.5	1.740	.97253	19.99838	.19989	795.6	1.704	.95352	19.60744	.26166
29	180	1.600	.200	.3941	821.4	1.762	.98442	20.24303	.14992	814.7	1.747	.97636	20.07712	.18520	797.2	1.707	.95543	19.64682	.25605
30	180	1.800	.225	.4434	824.6	1.769	.98825	20.32180	.13003	817.9	1.754	.98018	20.15585	.16933	798.8	1.711	.95734	19.68619	.25033
31	180	2.000	.250	.4926	827.8	1.776	.99209	20.40056	.10661	819.5	1.758	.98210	20.19522	.16085	798.8	1.711	.95734	19.68619	.25033
32	180	2.200	.275	.5419	829.4	1.780	.99400	20.43995	.09276	821.1	1.761	.98401	20.23459	.15191	798.8	1.711	.95734	19.68619	.25033
33	180	2.400	.300	.5912	831.0	1.784	.99592	20.47933	.07649	822.7	1.765	.98593	20.27395	.14243	798.8	1.711	.95734	19.68619	.25033
34	180	2.600	.325	.6404	831.0	1.784	.99592	20.47933	.07649	822.7	1.765	.98593	20.27395	.14243	795.6	1.704	.95352	19.60744	.26166
35	180	2.800	.350	.6897	831.0	1.784	.99592	20.47933	.07649	821.1	1.761	.98401	20.23459	.15191	794.0	1.700	.95160	19.56807	.26716
36	180	3.000	.375	.7389	831.0	1.784	.99592	20.47933	.07649	819.5	1.758	.98210	20.19522	.16085	789.2	1.689	.94586	19.44995	.28312
37	180	3.200	.400	.7882	826.2	1.773	.99017	20.36118	.11888	814.7	1.747	.97636	20.07712	.18520	782.9	1.675	.93820	19.29246	.30327
38	180	3.400	.425	.8375	819.8	1.758	.98251	20.20365	.15897	806.7	1.729	.96678	19.88028	.22021	771.7	1.650	.92479	19.01686	.33608
39	180	3.600	.450	.8867	805.4	1.726	.96527	19.84920	.22528	790.7	1.693	.94764	19.48661	.27825	754.1	1.610	.90373	18.58376	.38303
40	180	3.800	.475	.9360	776.7	1.661	.93080	19.14030	.32172	763.4	1.624	.91127	18.73864	.36677	720.5	1.534	.86352	17.75694	.46268
41	180	4.000	.500	.9852	712.8	1.517	.85419	17.56496	.47989	693.3	1.473	.83086	17.08523	.52138	651.8	1.379	.78119	16.06393	.60457
42	270	1.000	.125	.2463	747.9	1.596	.89632	18.43140	.39854	768.4	1.642	.92084	18.93548	.34528	789.2	1.689	.94586	19.44995	.28312
43	270	2.000	.250	.4926	741.5	1.582	.88866	18.27386	.41413	770.0	1.646	.92275	18.97485	.34085	798.8	1.711	.95734	19.68619	.25033
44	270	3.000	.375	.7389	711.2	1.513	.85227	17.52558	.48337	753.8	1.603	.89978	18.50244	.39136	790.8	1.693	.94777	19.48933	.27789
45	270	4.000	.500	.9852	552.9	1.156	.66267	13.62663	.78980	597.4	1.257	.71599	14.72322	.70766	648.7	1.372	.77736	15.98518	.61077
46	90	1.000	.125	.2463	740.7	1.580	.88773	18.25476	.41599	728.4	1.552	.87298	17.95131	.44484	719.7	1.532	.86257	17.73728	.46446
47	90	2.000	.250	.4926	734.3	1.565	.88006	18.09706	.43114	710.9	1.512	.85192	17.51827	.48402	695.8	1.478	.83382	17.14603	.51623
48	90	3.000	.375	.7389	704.0	1.497	.84364	17.34794	.49890	674.1	1.430	.80789	16.61283	.56057	655.8	1.388	.78590	16.16063	.59692
49	90	4.000	.500	.9852	544.0	1.136	.65190	13.40523	.80633	517.6	1.076	.62027	12.75488	.85500	503.8	1.045	.60380	12.41609	.88049

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VII.- DATA[a] FOR 160° CONE; $M_\infty = 3.95$ - Concluded

(e) $\alpha = 20°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 5762.6 psf					Φ = 90.0°, p_t = 5762.6 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	731.1	1.558	.87617	18.01695	.43871	730.9	1.558	.87593	18.01194	.43918
2	0	.200	.025	.0493	727.9	1.551	.87233	17.93810	.44607	734.1	1.565	.87976	18.09076	.43174
3	0	.400	.050	.0985	729.5	1.554	.87425	17.97752	.44240	738.9	1.576	.88551	18.20900	.42042
4	0	.600	.075	.1478	731.1	1.558	.87617	18.01695	.43871	740.5	1.579	.88743	18.24842	.41660
5	0	.800	.100	.1971	731.1	1.558	.87617	18.01695	.43871	742.1	1.583	.88934	18.28783	.41276
6	0	1.000	.125	.2463	727.9	1.551	.87233	17.93810	.44607	743.7	1.586	.89126	18.32724	.40889
7	0	1.200	.150	.2956	726.3	1.547	.87042	17.89868	.44972	742.1	1.583	.88934	18.28783	.41276
8	0	1.400	.175	.3448	723.1	1.540	.86658	17.81983	.45696	742.1	1.583	.88934	18.28783	.41276
9	0	1.600	.200	.3941	719.9	1.533	.86275	17.74098	.46413	738.9	1.576	.88551	18.20900	.42042
10	0	1.800	.225	.4434	715.1	1.522	.85700	17.62270	.47475	737.3	1.572	.88359	18.16959	.42422
11	0	2.000	.250	.4926	710.3	1.511	.85125	17.50443	.48524	734.1	1.565	.87976	18.09076	.43174
12	0	2.200	.275	.5419	707.1	1.504	.84741	17.42558	.49215	730.9	1.558	.87593	18.01194	.43918
13	0	2.400	.300	.5912	699.1	1.486	.83782	17.22846	.50919	726.1	1.547	.87018	17.89370	.45017
14	0	2.600	.325	.6404	692.7	1.471	.83016	17.07076	.52260	721.3	1.536	.86443	17.77546	.46100
15	0	2.800	.350	.6897	684.7	1.453	.82057	16.87364	.53911	713.3	1.518	.85484	17.57839	.47870
16	0	3.000	.375	.7389	675.1	1.432	.80907	16.63709	.55859	705.3	1.500	.84526	17.38132	.49601
17	0	3.200	.400	.7882	660.7	1.399	.79181	16.28227	.58724	692.5	1.471	.82993	17.06602	.52300
18	0	3.400	.425	.8375	646.3	1.367	.77456	15.92746	.61530	678.1	1.439	.81267	16.71129	.55252
19	0	3.600	.450	.8867	623.9	1.316	.74772	15.37551	.65808	657.3	1.392	.78776	16.19892	.59388
20	0	3.800	.475	.9360	587.1	1.233	.70362	14.46875	.72681	618.9	1.305	.74176	15.25300	.66746
21	0	4.000	.500	.9852	534.3	1.114	.64035	13.16775	.82407	563.0	1.179	.67467	13.87353	.77137
22	180	.200	.025	.0493	751.1	1.603	.90009	18.50888	.39071	742.9	1.585	.89027	18.30698	.41089
23	180	.400	.050	.0985	757.5	1.618	.90775	18.66640	.37442	746.1	1.592	.89410	18.38562	.40311
24	180	.600	.075	.1478	762.2	1.628	.91350	18.78454	.36185	747.7	1.595	.89601	18.42499	.39918
25	180	.800	.100	.1971	767.0	1.639	.91924	18.90268	.34893	749.3	1.599	.89793	18.46436	.39522
26	180	1.000	.125	.2463	768.6	1.643	.92116	18.94206	.34454	749.3	1.599	.89793	18.46436	.39522
27	180	1.200	.150	.2956	770.2	1.646	.92307	18.98144	.34010	749.3	1.599	.89793	18.46436	.39522
28	180	1.400	.175	.3448	771.8	1.650	.92499	19.02082	.33562	747.7	1.595	.89601	18.42499	.39918
29	180	1.600	.200	.3941	771.8	1.650	.92499	19.02082	.33562	746.1	1.592	.89410	18.38562	.40311
30	180	1.800	.225	.4434	771.8	1.650	.92499	19.02082	.33562	744.5	1.588	.89218	18.34625	.40702
31	180	2.000	.250	.4926	773.2	1.646	.92307	18.98144	.34010	741.3	1.581	.88835	18.26751	.41475
32	180	2.200	.275	.5419	768.6	1.643	.92116	18.94206	.34454	736.5	1.570	.88261	18.14940	.42615
33	180	2.400	.300	.5912	765.4	1.636	.91733	18.86330	.35328	731.7	1.559	.87687	18.03129	.43736
34	180	2.600	.325	.6404	762.2	1.628	.91350	18.78454	.36185	726.9	1.549	.87112	17.91318	.44837
35	180	2.800	.350	.6897	757.5	1.618	.90775	18.66640	.37442	720.5	1.534	.86346	17.75571	.46279
36	180	3.000	.375	.7389	751.1	1.603	.90009	18.50888	.39071	712.5	1.516	.85389	17.55886	.48043
37	180	3.200	.400	.7882	739.9	1.578	.88669	18.23321	.41808	699.7	1.487	.83858	17.24390	.50787
38	180	3.400	.425	.8375	727.1	1.549	.87137	17.91817	.44791	685.4	1.455	.82134	16.88957	.53779
39	180	3.600	.450	.8867	706.3	1.502	.84647	17.40622	.49384	661.4	1.401	.79263	16.29903	.58590
40	180	3.800	.475	.9360	669.6	1.419	.80242	16.50047	.56970	624.6	1.318	.74859	15.39353	.65670
41	180	4.000	.500	.9852	600.8	1.264	.72007	14.80710	.70133	557.5	1.166	.66818	13.74000	.78134
42	270	1.000	.125	.2463	800.6	1.715	.95946	19.72968	.24387	808.4	1.732	.96477	19.92104	.21340
43	270	2.000	.250	.4926	821.4	1.762	.98436	20.24162	.15025	827.5	1.776	.99174	20.39347	.10892
44	270	3.000	.375	.7389	821.4	1.762	.98436	20.24162	.15025	830.7	1.783	.99557	20.47221	.07967
45	270	4.000	.500	.9852	693.5	1.473	.83115	17.09118	.52088	709.3	1.509	.85006	17.48012	.48737
46	90	1.000	.125	.2463	715.1	1.522	.85700	17.62270	.47475	714.9	1.522	.85676	17.61780	.47519
47	90	2.000	.250	.4926	689.5	1.464	.82632	16.99191	.52924	687.7	1.460	.82417	16.94777	.53294
48	90	3.000	.375	.7389	647.9	1.370	.77647	15.96688	.61221	644.5	1.363	.77242	15.88361	.61874
49	90	4.000	.500	.9852	499.1	1.035	.59817	12.30041	.88923	499.0	1.034	.59801	12.29699	.88949

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VIII.- DATA[a] FOR 160° CONE; $M_\infty = 4.63$

(a) $\alpha = 0°$

Orifice	θ, deg	s, in.	s/D	s/s*	$\Phi = 0.0°$, $p_t = 7878.9$ psf				
					p_t, psf	C_p	$p_t/p_{t,2}$	p_t/p_∞	M_t
1	0	.000	.000	.0000	634.4	1.757	.97510	27.36611	.19014
2	0	.200	.025	.0493	632.8	1.752	.97264	27.29718	.19946
3	0	.400	.050	.0985	631.2	1.748	.97019	27.22825	.20839
4	0	.600	.075	.1478	631.2	1.748	.97019	27.22825	.20839
5	0	.800	.100	.1971	631.2	1.748	.97019	27.22825	.20839
6	0	1.000	.125	.2463	628.0	1.739	.96527	27.09038	.22527
7	0	1.200	.150	.2956	626.4	1.734	.96282	27.02145	.23329
8	0	1.400	.175	.3448	623.2	1.725	.95791	26.88359	.24863
9	0	1.600	.200	.3941	621.6	1.720	.95545	26.81465	.25599
10	0	1.800	.225	.4434	618.4	1.711	.95054	26.67679	.27018
11	0	2.000	.250	.4926	615.2	1.702	.94563	26.53892	.28374
12	0	2.200	.275	.5419	610.4	1.688	.93826	26.33213	.30312
13	0	2.400	.300	.5912	605.6	1.674	.93089	26.12533	.32159
14	0	2.600	.325	.6404	599.2	1.656	.92106	25.84960	.34476
15	0	2.800	.350	.6897	592.8	1.638	.91124	25.57387	.36683
16	0	3.000	.375	.7389	584.8	1.615	.89896	25.22921	.39308
17	0	3.200	.400	.7882	572.0	1.578	.87931	24.67775	.43262
18	0	3.400	.425	.8375	559.3	1.541	.85966	24.12629	.46985
19	0	3.600	.450	.8867	540.1	1.486	.83019	23.29911	.52255
20	0	3.800	.475	.9360	508.1	1.394	.78106	21.92046	.60478
21	0	4.000	.500	.9852	450.2	1.256	.70738	19.85249	.72100
22	180	.200	.025	.0493	643.2	1.783	.98874	27.74887	.12730
23	180	.400	.050	.0985	641.6	1.778	.98628	27.68002	.14060
24	180	.600	.075	.1478	640.0	1.773	.98383	27.61116	.15278
25	180	.800	.100	.1971	638.4	1.769	.98138	27.54231	.16409
26	180	1.000	.125	.2463	635.3	1.760	.97647	27.40459	.18475
27	180	1.200	.150	.2956	633.7	1.755	.97402	27.33574	.19430
28	180	1.400	.175	.3448	632.1	1.750	.97156	27.26688	.20343
29	180	1.600	.200	.3941	630.5	1.746	.96911	27.19803	.21219
30	180	1.800	.225	.4434	627.3	1.737	.96420	27.06032	.22880
31	180	2.000	.250	.4926	624.1	1.728	.95930	26.92260	.24437
32	180	2.200	.275	.5419	619.3	1.714	.95194	26.71604	.26620
33	180	2.400	.300	.5912	614.5	1.700	.94458	26.50947	.28657
34	180	2.600	.325	.6404	609.7	1.686	.93722	26.30290	.30577
35	180	2.800	.350	.6897	603.3	1.668	.92740	26.02748	.32990
36	180	3.000	.375	.7389	595.4	1.645	.91513	25.68320	.35820
37	180	3.200	.400	.7882	582.6	1.608	.89551	25.13235	.40022
38	180	3.400	.425	.8375	569.8	1.571	.87588	24.58151	.43927
39	180	3.600	.450	.8867	553.7	1.516	.84644	23.75524	.49389
40	180	3.800	.475	.9360	518.7	1.425	.79737	22.37812	.57808
41	180	4.000	.500	.9852	461.3	1.259	.70905	19.89932	.71842
42	270	1.000	.125	.2463	635.3	1.760	.97647	27.40459	.18475
43	270	2.000	.250	.4926	619.3	1.714	.95194	26.71604	.26620
44	270	3.000	.375	.7389	587.4	1.622	.90287	25.33892	.38487
45	270	4.000	.500	.9852	450.1	1.227	.69187	19.41733	.74492
46	90	1.000	.125	.2463	626.4	1.734	.96282	27.02145	.23329
47	90	2.000	.250	.4926	612.0	1.693	.94071	26.40106	.29678
48	90	3.000	.375	.7389	581.6	1.605	.89405	25.09135	.40322
49	90	4.000	.500	.9852	444.2	1.210	.68282	19.16317	.75885

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VIII.- DATA[a] FOR 160° CONE; $M_\infty = 4.63$ - Continued

(b) $\alpha = 5°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 7878.9 psf					Φ = 22.5°, p_t = 7878.9 psf					Φ = 45.0°, p_t = 7878.9 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	631.2	1.748	.97019	27.22825	.20839	631.1	1.748	.97012	27.22635	.20863	629.7	1.744	.96800	27.16687	.21605
2	0	.200	.025	.0493	626.4	1.734	.96282	27.02145	.23329	626.3	1.734	.96275	27.01957	.23350	628.1	1.739	.96554	27.09792	.22437
3	0	.400	.050	.0985	626.4	1.734	.96282	27.02145	.23329	624.7	1.729	.96030	26.95064	.24127	625.5	1.735	.96309	27.02897	.23242
4	0	.600	.075	.1478	623.2	1.725	.95791	26.88359	.24863	623.1	1.725	.95784	26.88172	.24883	624.9	1.730	.96063	26.96001	.24023
5	0	.800	.100	.1971	621.6	1.720	.95545	26.81465	.25599	619.9	1.716	.95293	26.74386	.26336	621.8	1.721	.95572	26.82211	.25520
6	0	1.000	.125	.2463	618.4	1.711	.95054	26.67679	.27018	618.3	1.711	.95047	26.67493	.27036	620.2	1.716	.95326	26.75316	.26240
7	0	1.200	.150	.2956	613.6	1.697	.94317	26.46999	.29032	613.5	1.697	.94310	26.46815	.29050	615.4	1.702	.94589	26.54631	.28303
8	0	1.400	.175	.3448	610.4	1.688	.93826	26.33213	.30312	610.4	1.688	.93819	26.33030	.30328	612.2	1.693	.94097	26.40860	.29610
9	0	1.600	.200	.3941	605.6	1.674	.93089	26.12533	.32150	607.2	1.679	.93328	26.19244	.31563	609.0	1.684	.93606	26.27050	.30869
10	0	1.800	.225	.4434	602.4	1.665	.92598	25.98747	.33329	602.4	1.665	.92591	25.98566	.33344	604.2	1.670	.92869	26.06365	.32682
11	0	2.000	.250	.4926	597.6	1.651	.91861	25.78067	.35038	597.6	1.651	.91854	25.77888	.35052	599.4	1.656	.92132	25.85679	.34417
12	0	2.200	.275	.5419	592.8	1.638	.91124	25.57387	.36683	592.8	1.638	.91118	25.57209	.36697	594.6	1.643	.91395	25.64994	.36085
13	0	2.400	.300	.5912	586.4	1.619	.90141	25.29814	.38793	586.4	1.619	.90135	25.29638	.38806	588.2	1.624	.90412	25.37413	.38220
14	0	2.600	.325	.6404	578.4	1.596	.88913	24.95348	.41318	580.0	1.601	.89153	25.02067	.40835	583.4	1.611	.89675	25.16728	.39766
15	0	2.800	.350	.6897	572.0	1.578	.87931	24.67775	.43262	572.0	1.578	.87925	24.67604	.43274	575.4	1.588	.88447	24.82252	.42249
16	0	3.000	.375	.7389	562.5	1.550	.86457	24.26416	.46073	562.4	1.550	.86451	24.26247	.46084	565.8	1.560	.86973	24.40881	.45103
17	0	3.200	.400	.7882	549.7	1.514	.84492	23.71270	.49661	551.2	1.518	.84732	23.77998	.49231	554.6	1.528	.85253	23.92615	.48291
18	0	3.400	.425	.8375	536.9	1.477	.82527	23.16124	.53105	536.9	1.477	.82522	23.15963	.53114	540.2	1.486	.83042	23.30559	.52215
19	0	3.600	.450	.8867	517.7	1.422	.79580	22.33406	.58067	519.3	1.426	.79820	22.40143	.57671	522.7	1.436	.80339	22.54712	.56809
20	0	3.800	.475	.9360	485.8	1.330	.74668	20.95541	.65972	485.7	1.330	.74662	20.95395	.65980	490.7	1.344	.75425	21.16809	.64774
21	0	4.000	.500	.9852	441.0	1.201	.67790	19.02531	.76640	441.0	1.201	.67786	19.02398	.76648	444.3	1.211	.68301	19.16850	.75856
22	180	.200	.025	.0493	641.6	1.778	.98628	27.68002	.14060	641.6	1.778	.98622	27.67809	.14095	640.2	1.774	.98410	27.61884	.15147
23	180	.400	.050	.0985	643.2	1.783	.98874	27.74887	.12730	641.6	1.778	.98622	27.67809	.14095	640.2	1.774	.98410	27.61884	.15147
24	180	.600	.075	.1478	643.2	1.783	.98874	27.74887	.12730	641.6	1.778	.98622	27.67809	.14095	640.2	1.774	.98410	27.61884	.15147
25	180	.800	.100	.1971	641.6	1.778	.98628	27.68002	.14060	640.0	1.773	.98376	27.60926	.15111	638.6	1.769	.98165	27.54997	.16287
26	180	1.000	.125	.2463	641.6	1.778	.98628	27.68002	.14060	640.0	1.773	.98376	27.60924	.15311	637.0	1.765	.97920	27.48109	.17356
27	180	1.200	.150	.2956	643.0	1.773	.98383	27.61116	.15278	638.4	1.769	.98131	27.54039	.16440	635.4	1.760	.97674	27.41222	.18366
28	180	1.400	.175	.3448	638.4	1.769	.98138	27.54231	.16409	636.8	1.764	.97886	27.47154	.17499	633.8	1.756	.97429	27.34334	.19326
29	180	1.600	.200	.3941	636.9	1.764	.97892	27.47345	.17471	635.2	1.759	.97640	27.40269	.18502	630.6	1.746	.96938	27.20559	.21125
30	180	1.800	.225	.4434	635.3	1.760	.97647	27.40459	.18475	632.0	1.750	.97150	27.26499	.20367	629.0	1.742	.96693	27.13672	.21973
31	180	2.000	.250	.4926	632.1	1.750	.97156	27.26688	.20343	630.4	1.746	.96904	27.19614	.21243	625.9	1.733	.96202	26.99897	.23585
32	180	2.200	.275	.5419	628.9	1.741	.96666	27.12917	.22064	627.2	1.737	.96414	27.05843	.22902	622.7	1.723	.95711	26.86122	.25104
33	180	2.400	.300	.5912	625.7	1.732	.96175	26.99146	.23670	622.4	1.723	.95678	26.85188	.25204	617.9	1.710	.94975	26.65459	.27243
34	180	2.600	.325	.6404	622.5	1.723	.95584	26.85375	.25184	617.7	1.709	.94942	26.64533	.27332	613.1	1.696	.94238	26.44797	.29240
35	180	2.800	.350	.6897	616.1	1.705	.94703	26.57833	.27992	612.9	1.695	.94206	26.43878	.29326	606.7	1.678	.93257	26.17247	.31739
36	180	3.000	.375	.7389	609.7	1.686	.93722	26.30290	.30577	606.5	1.677	.93224	26.16337	.31818	600.3	1.659	.92275	25.89697	.34085
37	180	3.200	.400	.7882	600.1	1.659	.92250	25.88977	.34145	595.3	1.645	.91507	25.68141	.35835	593.1	1.627	.90557	25.41484	.37911
38	180	3.400	.425	.8375	587.4	1.622	.90287	25.33892	.38487	584.1	1.613	.89790	25.19946	.39528	576.4	1.590	.88594	24.86384	.41957
39	180	3.600	.450	.8867	569.8	1.571	.87588	24.58151	.43927	565.0	1.558	.86846	24.37325	.45342	558.8	1.540	.85894	24.10622	.47117
40	180	3.800	.475	.9360	537.9	1.480	.82681	23.20439	.52840	534.7	1.470	.82185	23.06508	.53693	526.9	1.448	.80986	22.72872	.55726
41	180	4.000	.500	.9852	480.4	1.315	.73849	20.72559	.67259	476.8	1.310	.73598	20.65529	.67652	471.0	1.287	.72397	20.31810	.69527
42	270	1.000	.125	.2463	633.7	1.755	.97402	27.33574	.19430	635.2	1.759	.97640	27.40269	.18502	638.6	1.769	.98165	27.54997	.16287
43	270	2.000	.250	.4926	617.7	1.709	.94948	26.64718	.27314	622.4	1.723	.95678	26.85188	.25204	627.4	1.737	.96447	27.06784	.22792
44	270	3.000	.375	.7389	587.4	1.622	.90287	25.33892	.38487	592.1	1.636	.91016	25.54371	.36918	600.3	1.659	.92275	25.89697	.34085
45	270	4.000	.500	.9852	451.7	1.232	.69432	19.48618	.74114	458.1	1.250	.70409	19.76023	.72608	466.2	1.274	.71660	20.11148	.70671
46	90	1.000	.125	.2463	623.2	1.725	.95791	26.88359	.24863	619.9	1.716	.95293	26.74386	.26336	618.6	1.712	.95080	26.68421	.26943
47	90	2.000	.250	.4926	610.4	1.688	.93826	26.33213	.30312	604.0	1.670	.92837	26.05459	.32759	599.4	1.656	.92132	25.85679	.34417
48	90	3.000	.375	.7389	578.4	1.596	.88713	24.95348	.41318	572.0	1.578	.87925	24.67604	.43274	565.8	1.560	.86973	24.40881	.45103
49	90	4.000	.500	.9852	442.6	1.206	.68036	19.09424	.76263	434.6	1.183	.66803	18.74827	.78156	430.0	1.169	.66089	18.54794	.79252

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VIII.- DATA[a] FOR 160° CONE; $M_\infty = 4.63$ - Continued

(b) $\alpha = 5°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 7878.9 psf					Φ = 90.0°, p_t = 7878.9 psf				
					p_t, psf	C_p	$p_t/p_{t,2}$	p_t/p_∞	M_t	p_t, psf	C_p	$p_t/p_{t,2}$	p_t/p_∞	M_t
1	0	.000	.000	.0000	630.3	1.745	.95887	27.19142	.21302	631.2	1.748	.97019	27.22825	.20839
2	0	.020	.025	.0493	628.7	1.741	.96642	27.12240	.22145	629.6	1.743	.96773	27.15931	.21698
3	0	.040	.050	.0985	627.1	1.736	.96396	27.05339	.22960	629.6	1.743	.96773	27.15931	.21698
4	0	.060	.075	.1478	627.1	1.736	.96396	27.05339	.22960	628.0	1.739	.96527	27.09038	.22527
5	0	.080	.100	.1971	623.9	1.727	.95904	26.91536	.24517	626.4	1.734	.96282	27.02145	.23329
6	0	1.000	.125	.2463	622.3	1.722	.95658	26.84635	.25263	623.2	1.725	.95791	26.88359	.24863
7	0	1.200	.150	.2956	617.5	1.709	.94920	26.63931	.27392	621.6	1.720	.95545	26.81465	.25599
8	0	1.400	.175	.3448	615.9	1.704	.94674	26.57029	.28071	618.4	1.711	.95054	26.67679	.27018
9	0	1.600	.200	.3941	612.7	1.695	.94183	26.43226	.29397	615.2	1.702	.94563	26.53892	.28374
10	0	1.800	.225	.4434	607.9	1.681	.93445	26.22522	.31273	612.0	1.693	.94071	26.40106	.29678
11	0	2.000	.250	.4926	603.1	1.667	.92707	26.01818	.33069	608.8	1.684	.93580	26.26320	.30934
12	0	2.200	.275	.5419	599.9	1.658	.92215	25.88015	.34224	606.0	1.670	.92843	26.05640	.32744
13	0	2.400	.300	.5912	593.5	1.640	.91232	25.60410	.36446	600.8	1.661	.92352	25.91853	.33906
14	0	2.600	.325	.6404	587.1	1.621	.90248	25.32804	.38569	596.4	1.642	.91370	25.64280	.36141
15	0	2.800	.350	.6897	580.7	1.603	.89264	25.05199	.40608	588.0	1.624	.90387	25.36708	.38274
16	0	3.000	.375	.7389	572.7	1.580	.88035	24.70692	.43059	580.0	1.601	.89159	25.02241	.40822
17	0	3.200	.400	.7882	561.5	1.548	.86313	24.22383	.46341	568.8	1.569	.87440	24.53989	.44212
18	0	3.400	.425	.8375	547.1	1.506	.84100	23.60270	.50358	556.1	1.532	.85475	23.98843	.47887
19	0	3.600	.450	.8867	529.5	1.456	.81395	22.84355	.55036	536.9	1.477	.82527	23.16124	.53105
20	0	3.800	.475	.9360	495.9	1.359	.76231	21.39426	.63493	504.9	1.385	.77615	21.78260	.61273
21	0	4.000	.500	.9852	451.1	1.230	.69346	19.46188	.74248	458.6	1.252	.70492	19.78356	.72480
22	180	.200	.025	.0493	640.1	1.774	.98390	27.61308	.15245	639.2	1.771	.98247	27.57291	.15916
23	180	.400	.050	.0985	638.5	1.769	.98145	27.54422	.16379	637.6	1.766	.98001	27.50398	.17008
24	180	.600	.075	.1478	636.9	1.764	.97899	27.47536	.17442	636.0	1.762	.97756	27.43504	.18037
25	180	.800	.100	.1971	635.3	1.760	.97656	27.40650	.18447	632.8	1.752	.97264	27.29718	.19946
26	180	1.000	.125	.2463	633.7	1.755	.97409	27.33764	.19404	631.2	1.748	.97019	27.22825	.20839
27	180	1.200	.150	.2956	630.5	1.746	.96918	27.19992	.21196	628.0	1.739	.96527	27.09038	.22527
28	180	1.400	.175	.3448	628.9	1.741	.96672	27.13106	.22041	624.8	1.729	.96036	26.95252	.24107
29	180	1.600	.200	.3941	625.7	1.732	.96182	26.99334	.23649	621.6	1.720	.95545	26.81465	.25599
30	180	1.800	.225	.4434	622.5	1.723	.95691	26.85562	.25164	618.4	1.711	.95054	26.67679	.27018
31	180	2.000	.250	.4926	619.3	1.714	.95200	26.71789	.26602	615.2	1.702	.94563	26.53892	.28374
32	180	2.200	.275	.5419	616.1	1.705	.94710	26.58017	.27974	610.4	1.688	.93826	26.31213	.30312
33	180	2.400	.300	.5912	611.4	1.691	.93973	26.37359	.29932	605.6	1.674	.93089	26.12533	.32150
34	180	2.600	.325	.6404	606.6	1.677	.93237	26.16701	.31787	599.2	1.656	.92106	25.84960	.34476
35	180	2.800	.350	.6897	598.6	1.654	.92011	25.82271	.34696	592.8	1.638	.91124	25.57387	.36683
36	180	3.000	.375	.7389	590.6	1.631	.90784	25.47840	.37424	584.8	1.615	.89896	25.22921	.39308
37	180	3.200	.400	.7882	581.0	1.604	.89312	25.06524	.40512	572.0	1.578	.87931	24.67775	.43262
38	180	3.400	.425	.8375	568.3	1.567	.87349	24.51436	.44386	559.3	1.541	.85966	24.12629	.46985
39	180	3.600	.450	.8867	549.1	1.512	.84404	23.68803	.49818	543.1	1.486	.83019	23.29911	.52255
40	180	3.800	.475	.9360	517.2	1.420	.79497	22.31082	.58204	508.1	1.394	.78106	21.92046	.60478
41	180	4.000	.500	.9852	459.7	1.255	.70664	19.83184	.72214	452.2	1.233	.69510	19.50783	.73996
42	270	1.000	.125	.2463	640.1	1.774	.98390	27.61308	.15245	660.8	1.775	.98492	27.64184	.14747
43	270	2.000	.250	.4926	630.5	1.746	.96918	27.19992	.21196	632.8	1.752	.97264	27.29718	.19946
44	270	3.000	.375	.7389	603.4	1.668	.92747	26.02929	.32975	608.8	1.684	.93580	26.26320	.30934
45	270	4.000	.500	.9852	472.5	1.292	.72627	20.38272	.69169	477.8	1.307	.73439	20.61075	.67900
46	90	1.000	.125	.2463	617.5	1.709	.94920	26.63931	.27392	615.8	1.707	.94808	26.60786	.27703
47	90	2.000	.250	.4926	596.7	1.649	.91723	25.74213	.35349	597.6	1.651	.91861	25.78067	.35038
48	90	3.000	.375	.7389	563.1	1.552	.86559	24.29284	.45881	562.5	1.550	.86457	24.26416	.46073
49	90	4.000	.500	.9852	427.1	1.161	.65657	18.42667	.79915	426.6	1.160	.65580	18.40492	.80034

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VIII.- DATA[a] FOR 160° CONE; $M_\infty = 4.63$ - Continued

(c) $\alpha = 10°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 7878.9 psf					Φ = 22.5°, p_t = 7878.9 psf					Φ = 45.0°, p_t = 7878.9 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.300	.000	.0000	615.4	1.703	.94502	26.55000	.28268	615.2	1.702	.94569	26.54077	.28357	615.4	1.703	.94595	26.54815	.28285
2	0	.200	.025	.0493	609.0	1.684	.93619	26.27415	.30836	608.8	1.684	.93587	26.26502	.30918	610.6	1.689	.93858	26.34128	.30228
3	0	.400	.050	.0985	607.5	1.680	.93373	26.20519	.31451	607.2	1.679	.93341	26.19608	.31531	607.4	1.680	.93367	26.20337	.31467
4	0	.630	.075	.1478	604.3	1.671	.92882	26.06727	.32651	604.0	1.670	.92850	26.05821	.32728	605.8	1.675	.93121	26.13441	.32071
5	0	.800	.100	.1971	601.1	1.661	.92391	25.92935	.33816	600.8	1.661	.92358	25.92034	.33891	604.2	1.670	.92876	26.06546	.32666
6	0	1.030	.125	.2463	597.9	1.652	.91899	25.79143	.34950	597.7	1.652	.91867	25.78246	.35023	601.0	1.661	.92384	25.92755	.33831
7	0	1.200	.150	.2956	593.1	1.638	.91162	25.58454	.36600	594.5	1.642	.91376	25.64459	.36127	596.2	1.647	.91647	25.72068	.35521
8	0	1.430	.175	.3448	588.3	1.625	.90425	25.37766	.38194	589.7	1.629	.90639	25.43778	.37736	593.0	1.638	.91156	25.58276	.36613
9	0	1.600	.200	.3941	585.1	1.615	.89933	25.23974	.39229	584.9	1.615	.89902	25.23097	.39295	588.2	1.624	.90418	25.37590	.38207
10	0	1.800	.225	.4434	580.3	1.602	.89196	25.03285	.40747	580.1	1.601	.89165	25.02415	.40809	585.0	1.615	.89927	25.23798	.39242
11	0	2.030	.250	.4926	575.5	1.588	.88459	24.82597	.42225	575.3	1.587	.88428	24.81734	.42285	580.2	1.601	.89190	25.03111	.40759
12	0	2.200	.275	.5419	567.5	1.565	.87230	24.48117	.44612	570.5	1.573	.87691	24.61053	.43727	575.4	1.588	.88453	24.82425	.42237
13	0	2.430	.300	.5912	562.7	1.551	.86493	24.27428	.46005	562.5	1.550	.86463	24.26585	.46061	569.0	1.569	.87470	24.54842	.44153
14	0	2.600	.325	.6404	556.3	1.533	.85510	23.99844	.47822	556.1	1.532	.85481	23.99010	.47876	562.7	1.551	.86487	24.27260	.46016
15	0	2.800	.350	.6897	546.7	1.505	.84036	23.58467	.50472	548.1	1.509	.84252	23.64541	.50088	554.7	1.528	.85259	23.92781	.48280
16	0	3.030	.375	.7389	538.7	1.492	.82807	23.23987	.52621	538.5	1.482	.82779	23.23179	.52671	545.1	1.500	.83785	23.51408	.50916
17	0	3.200	.400	.7882	525.9	1.445	.80842	22.68818	.55968	527.3	1.449	.81059	22.74923	.55603	533.9	1.468	.82065	23.03138	.53898
18	0	3.400	.425	.8375	513.1	1.409	.78476	22.13649	.59224	514.6	1.413	.79094	22.19773	.58868	521.1	1.431	.80099	22.47973	.57208
19	0	3.600	.450	.8867	495.6	1.358	.76173	21.37792	.63586	497.0	1.362	.76392	21.43943	.63237	501.9	1.376	.77151	21.65226	.62022
20	0	3.830	.475	.9360	465.2	1.271	.71504	20.06766	.70913	465.0	1.270	.71480	20.06069	.70952	471.5	1.289	.72482	20.34209	.69394
21	0	4.000	.500	.9852	422.0	1.147	.64870	18.20571	.81124	423.5	1.151	.65093	18.26832	.80782	428.4	1.165	.65848	18.48027	.79622
22	180	.230	.025	.0493	632.3	1.751	.97197	27.27826	.20194	630.5	1.746	.96918	27.19992	.21196	629.1	1.742	.96699	27.13860	.21950
23	180	.430	.050	.0985	637.1	1.765	.97933	27.48491	.17298	633.7	1.755	.97409	27.33764	.19404	630.7	1.746	.96945	27.20748	.21101
24	180	.630	.075	.1478	638.7	1.770	.98179	27.55380	.16226	636.9	1.764	.97899	27.47536	.17442	632.3	1.751	.97190	27.27636	.20219
25	180	.830	.100	.1971	640.3	1.774	.98424	27.62268	.15081	636.9	1.764	.97899	27.47536	.17442	632.3	1.751	.97190	27.27636	.20219
26	180	1.000	.125	.2463	641.9	1.779	.98670	27.69157	.13846	638.5	1.769	.98145	27.54422	.16379	633.9	1.756	.97436	27.34524	.19300
27	180	1.200	.150	.2956	641.9	1.779	.98670	27.69157	.13846	638.5	1.769	.98145	27.54422	.16379	632.3	1.751	.97190	27.27636	.20219
28	180	1.400	.175	.3448	641.9	1.779	.98670	27.69157	.13846	638.5	1.769	.98145	27.54422	.16379	632.3	1.751	.97190	27.27636	.20219
29	180	1.600	.200	.3941	641.9	1.779	.98670	27.69157	.13846	638.5	1.769	.98145	27.54422	.16379	630.7	1.746	.96945	27.20748	.21101
30	180	1.830	.225	.4434	641.9	1.779	.98670	27.69157	.13846	638.5	1.769	.98145	27.54422	.16379	630.7	1.746	.96945	27.20748	.21101
31	180	2.000	.250	.4926	640.3	1.774	.98424	27.62268	.15081	635.3	1.760	.97654	27.40650	.18447	627.5	1.737	.96454	27.06972	.22770
32	180	2.200	.275	.5419	638.7	1.770	.98179	27.55380	.16226	633.7	1.755	.97409	27.33764	.19404	624.3	1.728	.95963	26.93196	.24334
33	180	2.430	.300	.5912	635.5	1.760	.97688	27.41603	.18311	632.1	1.751	.97163	27.26878	.20318	622.7	1.724	.95718	26.86308	.25084
34	180	2.630	.325	.6404	632.3	1.751	.97197	27.27826	.20194	627.3	1.737	.96427	27.06220	.22858	617.9	1.710	.94981	26.65645	.27222
35	180	2.830	.350	.6897	629.1	1.742	.96706	27.14049	.21927	622.5	1.723	.95691	26.85562	.25164	613.1	1.696	.94245	26.44981	.29223
36	180	3.000	.375	.7389	622.7	1.724	.95724	26.86495	.25063	617.7	1.709	.94955	26.64903	.27295	606.7	1.678	.93263	26.17429	.31723
37	180	3.230	.400	.7882	614.8	1.701	.94997	26.52053	.28551	609.8	1.686	.93728	26.30473	.30560	598.8	1.655	.92036	25.82989	.34637
38	180	3.400	.425	.8375	605.2	1.673	.93024	26.10727	.32307	598.6	1.656	.92311	25.82271	.34696	586.0	1.618	.90073	25.27885	.38938
39	180	3.600	.450	.8867	587.6	1.623	.90324	25.34949	.38407	582.6	1.608	.89557	25.13410	.40009	568.4	1.567	.87373	24.52117	.44340
40	180	3.800	.475	.9360	558.9	1.540	.85906	24.10957	.47095	552.3	1.521	.84895	23.82575	.49938	538.1	1.480	.82710	23.21246	.52790
41	180	4.000	.500	.9852	503.0	1.379	.77316	21.69862	.61756	496.4	1.361	.76337	21.41563	.63372	482.2	1.320	.74120	20.80167	.66834
42	270	1.030	.125	.2463	619.6	1.714	.95233	26.72718	.26507	627.3	1.737	.96427	27.06220	.22858	633.9	1.756	.97436	27.34524	.19300
43	270	2.000	.250	.4926	608.4	1.682	.93515	26.24499	.31097	617.7	1.709	.94955	26.64903	.27295	629.1	1.742	.96699	27.13860	.21950
44	270	3.000	.375	.7389	578.0	1.595	.88852	24.93619	.41442	593.8	1.640	.91274	25.61613	.36352	608.3	1.682	.93509	26.24317	.31113
45	270	4.030	.500	.9852	445.5	1.214	.68480	19.21877	.75581	452.9	1.264	.71155	19.96956	.71455	479.0	1.310	.73629	20.66391	.67604
46	90	1.000	.125	.2463	610.6	1.689	.93865	26.34311	.30211	604.0	1.670	.92850	26.05821	.32728	599.4	1.657	.92138	25.85859	.34402
47	90	2.000	.250	.4926	599.5	1.657	.92145	25.86039	.34387	588.1	1.624	.90393	25.36884	.38261	580.2	1.601	.89190	25.03111	.40759
48	90	3.030	.375	.7389	573.7	1.574	.87122	24.61909	.43688	556.1	1.532	.85481	23.99010	.47876	546.7	1.505	.84030	23.59303	.50482
49	90	4.000	.500	.9852	436.4	1.188	.67081	18.82636	.77729	423.5	1.151	.65093	18.26832	.80782	414.0	1.124	.63637	17.85967	.83020

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VIII.- DATA[a] FOR 160° CONE; $M_\infty = 4.63$ - Continued

(c) $\alpha = 10°$ - Concluded

Orifice	e, deg	s, in.	s/D	s/s*	$\Phi = 67.5°$, $p_t = 7869.4$ psf					$\Phi = 90.0°$, $p_t = 7878.9$ psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	614.4	1.702	.94555	26.53693	.28394	615.8	1.704	.94655	26.56475	.28125
2	0	.200	.025	.0493	611.2	1.693	.94063	26.39871	.29699	614.2	1.699	.94409	26.49575	.28788
3	0	.400	.050	.0985	611.2	1.693	.94063	26.39871	.29699	614.2	1.699	.94409	26.49575	.28788
4	0	.600	.075	.1478	609.6	1.688	.93817	26.32961	.30334	614.2	1.699	.94409	26.49575	.28788
5	0	.800	.100	.1971	608.0	1.693	.93570	26.26050	.30959	612.6	1.694	.94163	26.42675	.29439
6	0	1.000	.125	.2463	604.8	1.674	.93078	26.12229	.32176	611.0	1.690	.93917	26.35775	.30077
7	0	1.200	.150	.2956	603.2	1.670	.92832	26.05318	.32771	609.4	1.685	.93671	26.28875	.30705
8	0	1.400	.175	.3448	600.0	1.660	.92339	25.91497	.33936	607.8	1.681	.93425	26.21975	.31322
9	0	1.600	.200	.3941	595.2	1.647	.91601	25.70765	.35625	604.6	1.671	.92934	26.08175	.32526
10	0	1.800	.225	.4434	592.0	1.637	.91108	25.56944	.36718	601.4	1.662	.92442	25.94376	.33696
11	0	2.000	.250	.4926	587.2	1.624	.90369	25.36212	.38311	598.2	1.653	.91950	25.80576	.34834
12	0	2.200	.275	.5419	584.0	1.614	.89877	25.22390	.39347	595.0	1.644	.91458	25.66776	.35943
13	0	2.400	.300	.5912	577.6	1.596	.88892	24.94748	.41361	590.2	1.630	.90721	25.46076	.37559
14	0	2.600	.325	.6404	572.8	1.582	.88153	24.74016	.42827	585.4	1.616	.89983	25.25376	.39125
15	0	2.800	.350	.6897	564.8	1.559	.86922	24.39462	.45198	579.0	1.598	.89000	24.97776	.41144
16	0	3.000	.375	.7389	556.8	1.536	.85691	24.04909	.47492	571.0	1.575	.87771	24.63277	.43573
17	0	3.200	.400	.7882	544.0	1.499	.83721	23.49624	.51028	559.8	1.543	.86050	24.14977	.46831
18	0	3.400	.425	.8375	532.8	1.467	.81997	23.01249	.54013	547.0	1.506	.84383	23.59778	.50389
19	0	3.600	.450	.8867	515.2	1.416	.79289	22.25232	.58547	529.4	1.455	.81378	22.83879	.55065
20	0	3.800	.475	.9360	483.2	1.324	.74364	20.87019	.66450	497.4	1.363	.76461	21.45880	.63126
21	0	4.000	.500	.9852	438.4	1.195	.67469	18.93520	.77134	451.0	1.230	.69331	19.45782	.74270
22	180	.200	.025	.0493	624.2	1.730	.96065	26.96069	.24016	623.1	1.725	.95777	26.87985	.24903
23	180	.400	.050	.0985	625.8	1.735	.96311	27.02965	.23235	623.1	1.725	.95777	26.87985	.24903
24	180	.600	.075	.1478	625.8	1.735	.96311	27.02965	.23235	621.5	1.720	.95532	26.81092	.25638
25	180	.800	.100	.1971	625.8	1.735	.96311	27.02965	.23235	619.9	1.715	.95286	26.74200	.26355
26	180	1.000	.125	.2463	624.2	1.730	.96065	26.96069	.24016	618.3	1.711	.95041	26.67308	.27055
27	180	1.200	.150	.2956	624.2	1.730	.96065	26.96069	.24016	615.1	1.702	.94549	26.53523	.28410
28	180	1.400	.175	.3448	622.6	1.725	.95820	26.89174	.24774	613.5	1.697	.94304	26.46631	.29067
29	180	1.600	.200	.3941	621.0	1.721	.95574	26.82279	.25513	611.9	1.693	.94058	26.39739	.29712
30	180	1.800	.225	.4434	619.4	1.716	.95328	26.75383	.26233	608.7	1.683	.93567	26.25954	.30967
31	180	2.000	.250	.4926	616.2	1.707	.94837	26.61593	.27624	603.9	1.670	.92830	26.05277	.32775
32	180	2.200	.275	.5419	613.0	1.698	.94346	26.47802	.28956	600.7	1.660	.92339	25.91493	.33936
33	180	2.400	.300	.5912	608.2	1.684	.93608	26.27116	.30863	595.9	1.647	.91632	25.70816	.35621
34	180	2.600	.325	.6404	605.1	1.675	.93117	26.13326	.32081	591.1	1.633	.90866	25.50139	.37246
35	180	2.800	.350	.6897	598.7	1.657	.92134	25.85744	.34411	583.1	1.610	.89638	25.15678	.39843
36	180	3.000	.375	.7389	592.3	1.638	.91152	25.58163	.36622	575.2	1.587	.88410	24.81217	.42322
37	180	3.200	.400	.7882	582.7	1.611	.89677	25.16791	.39761	564.0	1.555	.86691	24.32971	.45635
38	180	3.400	.425	.8375	569.9	1.574	.87712	24.61629	.43687	551.2	1.518	.84726	23.77833	.49242
39	180	3.600	.450	.8867	550.8	1.519	.84764	23.78885	.49175	532.0	1.463	.81779	22.95125	.54385
40	180	3.800	.475	.9360	520.4	1.431	.80095	22.47874	.57214	501.7	1.376	.77113	21.64172	.62082
41	180	4.000	.500	.9852	464.6	1.271	.71496	20.06538	.70926	447.3	1.219	.68763	19.29835	.75145
42	270	1.000	.125	.2463	638.6	1.771	.98277	27.58127	.15779	640.7	1.775	.98479	27.63800	.14815
43	270	2.000	.250	.4926	635.4	1.762	.97785	27.44337	.17916	639.1	1.771	.98233	27.56907	.15979
44	270	3.000	.375	.7389	617.8	1.712	.95083	26.68488	.26936	623.1	1.725	.95777	26.87985	.24903
45	270	4.000	.500	.9852	433.3	1.353	.75719	21.30653	.63991	498.5	1.366	.76622	21.50388	.62869
46	90	1.000	.125	.2463	596.8	1.651	.91847	25.77676	.35069	596.6	1.648	.91704	25.73676	.35392
47	90	2.000	.250	.4926	576.0	1.591	.88646	24.87837	.41854	575.8	1.589	.89508	24.83977	.42127
48	90	3.000	.375	.7389	540.8	1.490	.83228	23.35802	.51890	539.0	1.483	.82853	23.25278	.52541
49	90	4.000	.500	.9852	411.2	1.117	.63283	17.76039	.83564	409.5	1.110	.62939	17.66383	.84094

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VIII.- DATA[a] FOR 160° CONE; $M_\infty = 4.63$ - Continued

(d) $\alpha = 15°$

Orifice	θ, deg	s, in.	s/D	s/s*	$\Phi = 0.0°$, $p_t = 7869.4$ psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.200	.000	.0000	589.7	1.631	.90755	25.47022	.37487
2	0	.200	.025	.0493	581.7	1.608	.89525	25.12510	.40075
3	0	.400	.050	.0985	583.1	1.603	.89279	25.05607	.40578
4	0	.600	.075	.1478	578.5	1.599	.89033	24.98705	.41077
5	0	.800	.100	.1971	575.3	1.589	.88541	24.84900	.42062
6	0	1.000	.125	.2463	570.5	1.576	.87803	24.64192	.43513
7	0	1.200	.150	.2956	565.7	1.562	.87065	24.43485	.44927
8	0	1.400	.175	.3448	560.9	1.548	.86328	24.22777	.46315
9	0	1.600	.200	.3941	556.1	1.534	.85590	24.02070	.47677
10	0	1.800	.225	.4434	551.3	1.520	.84852	23.81362	.49016
11	0	2.000	.250	.4926	546.6	1.507	.84114	23.60655	.50334
12	0	2.200	.275	.5419	540.2	1.488	.83130	23.33045	.52061
13	0	2.400	.300	.5912	535.4	1.474	.82392	23.12337	.53337
14	0	2.600	.325	.6404	527.4	1.451	.81163	22.77825	.55429
15	0	2.800	.350	.6897	519.4	1.428	.79933	22.43312	.57484
16	0	3.000	.375	.7389	511.4	1.405	.78703	22.08800	.59506
17	0	3.200	.400	.7882	500.2	1.373	.76982	21.60482	.62293
18	0	3.400	.425	.8375	489.0	1.341	.75260	21.12165	.65036
19	0	3.600	.450	.8867	471.4	1.290	.72554	20.36237	.69282
20	0	3.800	.475	.9360	444.3	1.212	.68373	19.18895	.75744
21	0	4.000	.500	.9852	404.3	1.097	.62225	17.46332	.85195
22	180	.200	.025	.0493	609.8	1.689	.93848	26.33828	.30255
23	180	.400	.050	.0985	619.4	1.716	.95322	26.75197	.26252
24	180	.600	.075	.1478	624.2	1.730	.96059	26.95882	.24036
25	180	.800	.100	.1971	629.0	1.744	.96796	27.16567	.21620
26	180	1.000	.125	.2463	632.1	1.753	.97287	27.30356	.19861
27	180	1.200	.150	.2956	633.7	1.757	.97533	27.37251	.18925
28	180	1.400	.175	.3448	635.3	1.762	.97778	27.44146	.17944
29	180	1.600	.200	.3941	638.5	1.771	.98270	27.57936	.15810
30	180	1.800	.225	.4434	638.5	1.771	.98270	27.57936	.15810
31	180	2.000	.250	.4926	638.5	1.771	.98270	27.57936	.15810
32	180	2.200	.275	.5419	640.1	1.776	.98515	27.64830	.14633
33	180	2.400	.300	.5912	640.1	1.776	.98515	27.64830	.14633
34	180	2.600	.325	.6404	638.5	1.771	.98270	27.57936	.15810
35	180	2.800	.350	.6897	636.9	1.767	.98024	27.51041	.16909
36	180	3.000	.375	.7389	633.7	1.757	.97533	27.37251	.18925
37	180	3.200	.400	.7882	627.4	1.739	.96550	27.09672	.22452
38	180	3.400	.425	.8375	619.4	1.716	.95322	26.75197	.26252
39	180	3.600	.450	.8867	606.6	1.679	.93356	26.20039	.31493
40	180	3.800	.475	.9360	579.5	1.601	.89180	25.02827	.40780
41	180	4.000	.500	.9852	526.8	1.450	.81073	22.75297	.55580
42	270	1.000	.125	.2463	598.6	1.656	.92128	25.85565	.34426
43	270	2.000	.250	.4926	587.0	1.629	.90554	25.44196	.37704
44	270	3.000	.375	.7389	553.5	1.555	.86723	24.33878	.45574
45	270	4.000	.500	.9852	435.8	1.188	.67069	18.82291	.77748
46	90	1.000	.125	.2463	589.7	1.631	.90755	25.47022	.37487
47	90	2.000	.250	.4926	581.7	1.608	.89525	25.12510	.40075
48	90	3.000	.375	.7389	556.1	1.534	.85590	24.02070	.47677
49	90	4.000	.500	.9852	428.3	1.166	.65914	18.49870	.79521

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VIII.- DATA[a] FOR 160° CONE; $M_\infty = 4.63$ - Continued

(e) $\alpha = 20°$

Orifice	e, deg	s, in.	s/D	s/s*	$\Phi = 0.0°$, $p_t = 7878.9$ psf					$\Phi = 22.5°$, $p_t = 7878.9$ psf					$\Phi = 45.0°$, $p_t = 7869.4$ psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.030	.000	.0000	546.4	1.504	.83995	23.57320	.50544	546.7	1.505	.84030	23.58303	.50482	546.5	1.506	.84108	23.60491	.50344
2	0	.230	.025	.0493	538.5	1.481	.82767	23.22856	.52691	538.7	1.482	.82802	23.23825	.52631	540.1	1.488	.83124	23.32883	.52071
3	0	.430	.050	.0985	541.6	1.491	.83258	23.36642	.51838	541.9	1.491	.83293	23.37616	.51777	541.7	1.493	.83370	23.39785	.51642
4	0	.630	.075	.1478	541.5	1.491	.83258	23.36642	.51838	541.9	1.491	.83293	23.37616	.51777	541.7	1.493	.83370	23.39785	.51642
5	0	.830	.100	.1971	538.5	1.481	.82767	23.22856	.52691	538.7	1.482	.82802	23.23825	.52631	540.1	1.488	.83124	23.32883	.52071
6	0	1.030	.125	.2463	535.3	1.472	.82276	23.09071	.53536	537.1	1.477	.82556	23.16930	.53055	538.5	1.483	.82879	23.25981	.52498
7	0	1.230	.150	.2956	532.1	1.463	.81785	22.95285	.54375	533.9	1.468	.82065	23.03138	.53898	536.9	1.479	.82633	23.19079	.52923
8	0	1.430	.175	.3448	528.9	1.454	.81294	22.81500	.55208	530.7	1.459	.81573	22.89347	.54735	533.7	1.470	.82141	23.05275	.53768
9	0	1.630	.200	.3941	524.1	1.440	.80557	22.60821	.56445	525.9	1.445	.80836	22.68660	.55978	530.5	1.460	.81649	22.91471	.54606
10	0	1.830	.225	.4434	520.9	1.431	.80066	22.47036	.57263	522.7	1.436	.80345	22.54869	.56799	527.3	1.451	.81157	22.77667	.55438
11	0	2.000	.250	.4926	515.1	1.417	.79329	22.26358	.58481	517.9	1.422	.79608	22.34182	.58022	522.5	1.437	.80419	22.56961	.56675
12	0	2.230	.275	.5419	511.3	1.403	.78592	22.05679	.59688	513.1	1.408	.78870	22.13495	.59233	517.8	1.424	.79681	22.36254	.57900
13	0	2.430	.300	.5912	506.5	1.389	.77855	21.85001	.60885	508.3	1.395	.78133	21.92808	.60434	513.0	1.410	.78944	22.15548	.59113
14	0	2.630	.325	.6404	500.1	1.371	.76873	21.57430	.62468	501.9	1.376	.77151	21.65226	.62022	508.2	1.396	.78206	21.94842	.60316
15	0	2.830	.350	.6897	493.7	1.353	.75890	21.29859	.64036	495.5	1.358	.76168	21.37643	.63595	500.2	1.373	.76976	21.60332	.62302
16	0	3.030	.375	.7389	487.3	1.334	.74908	21.02288	.65593	489.1	1.340	.75185	21.10061	.65155	493.8	1.355	.75992	21.32724	.63874
17	0	3.230	.400	.7882	476.1	1.302	.73189	20.54039	.68292	479.5	1.312	.73711	20.68687	.67476	484.2	1.327	.74517	20.91312	.66209
18	0	3.430	.425	.8375	466.6	1.275	.71715	20.12682	.70586	468.3	1.280	.71991	20.20418	.70158	473.0	1.295	.72795	20.42998	.68906
19	0	3.630	.450	.8867	452.2	1.233	.69505	19.50648	.74003	454.0	1.238	.69779	19.58357	.73580	458.6	1.253	.70582	19.80880	.72341
20	0	3.830	.475	.9360	426.6	1.160	.65575	18.40364	.80041	428.4	1.165	.65848	18.48027	.79622	429.9	1.171	.66155	18.56643	.79151
21	0	4.000	.500	.9852	389.9	1.054	.59926	16.81830	.88754	390.0	1.055	.59951	16.82532	.88715	391.5	1.060	.60253	16.90995	.88246
22	180	.200	.025	.0493	576.2	1.590	.88563	24.85520	.42019	576.4	1.590	.88600	24.86557	.41945	569.9	1.574	.87700	24.61286	.43711
23	180	.400	.050	.0985	593.7	1.640	.91262	25.61256	.36380	590.8	1.632	.90809	25.48549	.37369	582.6	1.610	.89665	25.16441	.39787
24	180	.600	.075	.1478	603.3	1.668	.92734	26.02567	.33006	598.8	1.655	.92036	25.82989	.34637	587.4	1.624	.90402	25.37124	.38242
25	180	.800	.100	.1971	609.7	1.686	.93715	26.30107	.30593	606.7	1.678	.93263	26.17429	.31723	593.8	1.642	.91385	25.64702	.36108
26	180	1.000	.125	.2463	615.1	1.704	.94696	26.57648	.28012	611.5	1.691	.94000	26.38093	.29864	598.6	1.656	.92122	25.85385	.34441
27	180	1.200	.150	.2956	619.2	1.714	.95187	26.71418	.26639	616.3	1.705	.94736	26.58757	.27902	601.8	1.665	.92613	25.99174	.33293
28	180	1.400	.175	.3448	624.3	1.727	.95923	26.92073	.24458	619.5	1.714	.95227	26.72533	.26526	603.4	1.670	.92858	26.06068	.32707
29	180	1.600	.200	.3941	628.8	1.741	.96659	27.12728	.22086	622.7	1.724	.95718	26.86308	.25084	606.6	1.679	.93350	26.19857	.31509
30	180	1.830	.225	.4434	632.0	1.750	.97150	27.26499	.20367	625.9	1.733	.96208	27.00084	.23564	608.2	1.684	.93595	26.26751	.30896
31	180	2.000	.250	.4926	635.2	1.759	.97640	27.40269	.18502	629.1	1.742	.96699	27.13860	.21950	609.8	1.688	.93841	26.33645	.30272
32	180	2.200	.275	.5419	638.4	1.769	.98131	27.54039	.16440	630.7	1.746	.96945	27.20748	.21101	609.8	1.688	.93841	26.33645	.30272
33	180	2.400	.300	.5912	640.0	1.773	.98376	27.60924	.15311	632.3	1.751	.97190	27.27636	.20219	611.4	1.693	.94087	26.40540	.29637
34	180	2.600	.325	.6404	641.6	1.778	.98622	27.67809	.14095	633.9	1.756	.97436	27.34524	.19300	609.8	1.688	.93841	26.33645	.30272
35	180	2.800	.350	.6897	641.6	1.778	.98622	27.67809	.14095	633.9	1.756	.97436	27.34524	.19300	608.2	1.684	.93595	26.26751	.30896
36	180	3.000	.375	.7389	641.6	1.778	.98622	27.67809	.14095	633.9	1.756	.97436	27.34524	.19300	606.6	1.679	.93350	26.19857	.31509
37	180	3.200	.400	.7882	640.0	1.773	.98376	27.60924	.15311	630.7	1.746	.96945	27.20748	.21101	601.8	1.665	.92613	25.99174	.33293
38	180	3.430	.425	.8375	635.2	1.759	.97640	27.40269	.18502	624.3	1.728	.95963	26.93196	.24334	595.4	1.647	.91630	25.71596	.35559
39	180	3.630	.450	.8867	625.6	1.732	.96168	26.98958	.23691	614.7	1.701	.94490	26.51869	.28569	581.0	1.606	.89419	25.09547	.40292
40	180	3.830	.475	.9360	603.3	1.668	.92734	26.02567	.33006	592.4	1.636	.91054	25.55437	.36835	555.5	1.532	.85489	23.99237	.47861
41	180	4.000	.500	.9852	553.8	1.525	.85129	23.89129	.48516	542.9	1.494	.83446	23.41910	.51510	504.4	1.385	.77628	21.78618	.61253
42	270	1.000	.125	.2463	565.0	1.558	.86846	24.37325	.45342	581.2	1.604	.89336	25.07221	.40461	597.0	1.652	.91876	25.78490	.35003
43	270	2.000	.250	.4926	560.2	1.544	.86110	24.16669	.46719	582.8	1.609	.89582	25.14109	.39958	608.2	1.684	.93595	26.26751	.30896
44	270	3.000	.375	.7389	537.9	1.480	.82675	23.20278	.52849	570.0	1.572	.87618	24.59005	.43868	603.4	1.670	.92858	26.06068	.32707
45	270	4.000	.500	.9852	419.7	1.140	.64521	18.10781	.81660	453.5	1.237	.69702	19.56184	.73699	499.6	1.371	.76831	21.57935	.62439
46	90	1.000	.125	.2463	557.6	1.536	.85714	24.05569	.47448	545.1	1.500	.83785	23.51408	.50916	538.5	1.483	.82879	23.25981	.52498
47	90	2.000	.250	.4926	554.4	1.527	.85223	23.91783	.48345	535.5	1.473	.82310	23.10034	.53478	522.5	1.437	.80419	22.56961	.56675
48	90	3.000	.375	.7389	533.7	1.468	.82030	23.02178	.53957	509.9	1.399	.78379	21.99704	.60035	495.4	1.359	.76238	21.39626	.63482
49	90	4.000	.500	.9852	412.2	1.118	.63365	17.78329	.83438	391.6	1.059	.60197	16.89428	.88333	381.9	1.033	.58777	16.49583	.90544

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE VIII.- DATA[a] FOR 160° CONE; $M_\infty = 4.63$ - Concluded

(e) $\alpha = 20°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 7869.4 psf					Φ = 90.0°, p_t = 7869.4 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	548.0	1.511	.84342	23.67064	.49928	544.8	1.501	.83845	23.53098	.50810
2	0	.200	.025	.0493	543.2	1.497	.83605	23.46360	.51232	545.4	1.506	.84091	23.59998	.50375
3	0	.400	.050	.0985	544.8	1.502	.83851	23.53261	.50799	551.2	1.520	.84828	23.80700	.49058
4	0	.600	.075	.1478	548.0	1.511	.84342	23.67064	.49928	554.4	1.529	.85320	23.94501	.48169
5	0	.800	.100	.1971	548.0	1.511	.84342	23.67064	.49928	556.0	1.534	.85566	24.01402	.47720
6	0	1.000	.125	.2463	546.4	1.506	.84096	23.60163	.50365	556.0	1.534	.85566	24.01402	.47720
7	0	1.200	.150	.2956	544.8	1.502	.83851	23.53261	.50799	556.0	1.534	.85556	24.01402	.47720
8	0	1.400	.175	.3448	543.2	1.497	.83605	23.46360	.51232	556.0	1.534	.85566	24.01402	.47720
9	0	1.600	.200	.3941	540.0	1.488	.83113	23.32558	.52091	554.4	1.529	.85320	23.94501	.48169
10	0	1.800	.225	.4434	538.5	1.483	.82867	23.25657	.52518	552.8	1.524	.85074	23.87601	.48615
11	0	2.000	.250	.4926	535.3	1.474	.82375	23.11855	.53366	551.2	1.520	.84828	23.80700	.49058
12	0	2.200	.275	.5419	532.1	1.465	.81883	22.98053	.54207	548.0	1.511	.84337	23.66899	.49938
13	0	2.400	.300	.5912	527.3	1.451	.81146	22.77350	.55457	544.8	1.501	.83845	23.53098	.50810
14	0	2.600	.325	.6404	522.5	1.437	.80408	22.56647	.56694	541.6	1.492	.83353	23.39297	.51673
15	0	2.800	.350	.6897	516.1	1.419	.79424	22.29042	.58323	536.8	1.478	.82615	23.18595	.52953
16	0	3.000	.375	.7389	509.7	1.400	.78441	22.01438	.59934	530.4	1.460	.81632	22.90993	.54635
17	0	3.200	.400	.7882	500.1	1.373	.76965	21.60032	.62319	522.4	1.437	.80402	22.56490	.56703
18	0	3.400	.425	.8375	487.3	1.336	.74998	21.04823	.65450	511.3	1.405	.78681	22.08186	.59542
19	0	3.600	.450	.8867	472.9	1.295	.72785	20.42714	.68922	495.3	1.359	.76222	21.39180	.63507
20	0	3.800	.475	.9360	444.2	1.212	.68359	19.18495	.75766	466.5	1.276	.71797	20.14969	.70460
21	0	4.000	.500	.9852	404.2	1.097	.62212	17.45968	.85215	425.0	1.157	.65404	18.35554	.80305
22	180	.200	.025	.0493	563.4	1.555	.86705	24.33370	.45608	556.0	1.534	.85556	24.01402	.47720
23	180	.400	.050	.0985	571.4	1.578	.87933	24.67837	.43258	559.2	1.543	.86058	24.15203	.46816
24	180	.600	.075	.1478	574.6	1.587	.88426	24.81624	.42293	560.8	1.547	.86304	24.22104	.46359
25	180	.800	.100	.1971	577.8	1.596	.88916	24.95411	.41314	562.4	1.552	.86549	24.29004	.45900
26	180	1.000	.125	.2463	580.9	1.606	.89407	25.09198	.40317	564.0	1.557	.86795	24.35905	.45438
27	180	1.200	.150	.2956	582.5	1.610	.89652	25.16091	.39812	564.0	1.557	.86795	24.35905	.45438
28	180	1.400	.175	.3448	584.1	1.615	.89898	25.22985	.39303	564.0	1.557	.86795	24.35905	.45438
29	180	1.600	.200	.3941	584.1	1.615	.89898	25.22985	.39303	564.0	1.557	.86795	24.35905	.45438
30	180	1.800	.225	.4434	584.1	1.615	.89898	25.22985	.39303	562.4	1.552	.86549	24.29004	.45900
31	180	2.000	.250	.4926	584.1	1.615	.89898	25.22985	.39303	560.8	1.547	.86304	24.22104	.46359
32	180	2.200	.275	.5419	584.1	1.615	.89898	25.22985	.39303	557.6	1.538	.85812	24.08302	.47269
33	180	2.400	.300	.5912	582.5	1.610	.89652	25.16091	.39812	554.4	1.529	.85320	23.94501	.48169
34	180	2.600	.325	.6404	579.3	1.601	.89161	25.02304	.40818	551.2	1.520	.84828	23.80700	.49058
35	180	2.800	.350	.6897	576.2	1.592	.88670	24.88518	.41805	544.8	1.501	.83845	23.53098	.50810
36	180	3.000	.375	.7389	571.4	1.578	.87933	24.67837	.43258	540.0	1.488	.83107	23.32396	.52101
37	180	3.200	.400	.7882	563.4	1.555	.86705	24.33370	.45608	532.4	1.460	.81632	22.90993	.54635
38	180	3.400	.425	.8375	555.4	1.532	.85477	23.98903	.47883	520.8	1.433	.80157	22.49589	.57112
39	180	3.600	.450	.8867	539.4	1.486	.83021	23.29969	.52252	503.3	1.382	.77452	21.73683	.61536
40	180	3.800	.475	.9360	513.7	1.403	.78599	22.05888	.59676	474.5	1.299	.73026	20.49472	.68546
41	180	4.000	.500	.9852	458.1	1.252	.70494	19.78406	.72477	423.4	1.152	.65158	18.28654	.80682
42	270	1.000	.125	.2463	609.7	1.688	.93828	26.33279	.30305	613.5	1.699	.94418	26.49823	.28764
43	270	2.000	.250	.4926	627.2	1.739	.96530	27.09107	.22519	634.3	1.759	.97614	27.39530	.18606
44	270	3.000	.375	.7389	632.0	1.753	.97267	27.29787	.19937	640.7	1.777	.98597	27.67133	.14219
45	270	4.000	.500	.9852	539.4	1.486	.83021	23.29969	.52252	551.2	1.520	.84828	23.80700	.49058
46	90	1.000	.125	.2463	536.9	1.479	.82621	23.18756	.52943	535.2	1.474	.82369	23.11694	.53376
47	90	2.000	.250	.4926	519.3	1.428	.79916	22.42845	.57511	515.0	1.419	.79419	22.28887	.58333
48	90	3.000	.375	.7389	488.9	1.341	.75244	21.11724	.65061	485.7	1.331	.74747	20.97776	.65846
49	90	4.000	.500	.9852	378.7	1.023	.58277	16.35551	.91326	377.0	1.019	.58027	16.28537	.91718

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE IX.- DATA[a] FOR 180° CONE; $M_\infty = 2.30$

(a) $\alpha = 0°$

Orifice	e, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 2288.9 psf					Φ = 22.5°, p_t = 2289.8 psf					Φ = 45.0°, p_t = 2291.1 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.030	.000	.0000	1332.4	1.696	.99794	7.27872	.05430	1330.3	1.692	.99600	7.26461	.07565	1334.1	1.696	.99825	7.28095	.05009
2	0	.230	.025	.0500	1332.4	1.696	.99794	7.27872	.05430	1328.7	1.689	.99481	7.25589	.08626	1332.5	1.694	.99705	7.27223	.06498
3	0	.400	.050	.1000	1332.4	1.696	.99794	7.27872	.05430	1327.1	1.687	.99361	7.24716	.09572	1332.5	1.694	.99705	7.27223	.06498
4	0	.630	.075	.1500	1332.4	1.696	.99794	7.27872	.05430	1328.7	1.689	.99481	7.25589	.08626	1332.5	1.694	.99705	7.27223	.06498
5	0	.800	.100	.2000	1330.8	1.693	.99674	7.26999	.06829	1325.5	1.685	.99242	7.23844	.10433	1330.9	1.691	.99585	7.26351	.07706
6	0	1.030	.125	.2500	1327.6	1.689	.99435	7.25253	.09001	1323.9	1.682	.99122	7.22972	.11230	1329.3	1.689	.99466	7.25479	.08750
7	0	1.230	.150	.3000	1326.0	1.686	.99315	7.24381	.09912	1322.3	1.680	.99003	7.22100	.11975	1326.1	1.684	.99227	7.23735	.10536
8	0	1.490	.175	.3500	1322.8	1.681	.99076	7.22635	.11524	1317.5	1.673	.98644	7.19484	.13980	1322.9	1.680	.98988	7.21991	.12065
9	0	1.630	.200	.4000	1318.0	1.674	.98717	7.20017	.13595	1315.9	1.671	.98524	7.18612	.14589	1318.1	1.673	.98629	7.19375	.14057
10	0	1.830	.225	.4500	1313.2	1.667	.98358	7.17399	.15397	1311.1	1.664	.98166	7.15995	.16285	1313.3	1.666	.98270	7.16759	.15807
11	0	2.030	.250	.5000	1308.4	1.660	.97999	7.14780	.17017	1304.8	1.654	.97687	7.12507	.18313	1306.9	1.656	.97792	7.13272	.17887
12	0	2.230	.275	.5500	1303.6	1.653	.97640	7.12162	.18502	1296.8	1.642	.97090	7.08146	.20585	1298.9	1.644	.97194	7.08912	.20204
13	0	2.430	.300	.6000	1294.0	1.639	.96922	7.06926	.21180	1288.8	1.631	.96492	7.03786	.22645	1290.9	1.633	.96597	7.04552	.22296
14	0	2.600	.325	.6500	1282.8	1.623	.96085	7.00816	.23956	1279.2	1.616	.95774	6.98553	.24912	1279.7	1.616	.95760	6.98448	.24956
15	0	2.830	.350	.7000	1268.5	1.601	.95008	6.92962	.27148	1266.4	1.598	.94818	6.91577	.27677	1268.5	1.600	.94923	6.92344	.27385
16	0	3.030	.375	.7500	1252.5	1.578	.93811	6.84234	.30349	1248.9	1.572	.93502	6.81983	.31129	1249.4	1.571	.93488	6.81881	.31164
17	0	3.230	.400	.8000	1231.7	1.547	.92256	6.72888	.34131	1229.7	1.543	.92068	6.71518	.34565	1230.2	1.543	.92054	6.71417	.34597
18	0	3.430	.425	.8500	1203.0	1.505	.90102	6.57179	.38877	1200.9	1.501	.89915	6.55820	.39267	1201.4	1.501	.89902	6.55722	.39295
19	0	3.600	.450	.9000	1159.8	1.441	.86871	6.33615	.45295	1157.8	1.437	.86687	6.32274	.45642	1159.9	1.440	.86794	6.33050	.45441
20	0	3.830	.475	.9500	1084.7	1.330	.81247	5.92596	.55286	1082.8	1.327	.81057	5.91285	.55589	1083.2	1.326	.81055	5.91196	.55610
21	180	.200	.025	.0500	1335.6	1.700	1.00033	7.29617	.00000	1331.9	1.694	.99720	7.27333	.06330	1337.2	1.701	1.00064	7.29839	.00000
22	180	.400	.050	.1000	1334.0	1.698	.99914	7.28744	.03515	1330.3	1.692	.99600	7.26461	.07565	1335.7	1.699	.99944	7.28967	.02827
23	180	.530	.075	.1500	1332.4	1.696	.99794	7.27872	.05430	1328.7	1.689	.99481	7.25589	.08626	1334.1	1.696	.99825	7.28095	.05009
24	180	.800	.100	.2000	1330.8	1.693	.99674	7.26999	.06829	1327.1	1.687	.99361	7.24716	.09572	1332.5	1.694	.99705	7.27223	.06498
25	180	1.030	.125	.2500	1329.2	1.691	.99555	7.26126	.07988	1325.5	1.685	.99242	7.23844	.10433	1330.9	1.691	.99585	7.26351	.07706
26	180	1.200	.150	.3000	1326.0	1.686	.99315	7.24381	.09912	1325.5	1.685	.99242	7.23844	.10433	1327.7	1.687	.99346	7.24607	.09684
27	180	1.400	.175	.3500	1324.4	1.684	.99196	7.23508	.10748	1320.7	1.678	.98883	7.21228	.12678	1324.5	1.682	.99107	7.22863	.11326
28	180	1.630	.200	.4000	1319.6	1.677	.98837	7.20890	.12940	1317.5	1.673	.98644	7.19484	.13980	1319.7	1.675	.98749	7.20247	.13425
29	180	1.800	.225	.4500	1316.4	1.672	.98597	7.19144	.14220	1312.7	1.666	.98285	7.16867	.15739	1314.9	1.668	.98390	7.17631	.15245
30	180	2.030	.250	.5000	1313.0	1.663	.98119	7.15653	.16494	1306.3	1.656	.97807	7.13379	.17827	1310.1	1.661	.98031	7.15016	.16878
31	180	2.230	.275	.5500	1303.6	1.653	.97640	7.12162	.18592	1303.0	1.647	.97329	7.09891	.19706	1302.1	1.649	.97434	7.10656	.19308
32	180	2.430	.300	.6000	1295.6	1.641	.97042	7.07798	.20756	1292.0	1.635	.96731	7.05530	.21842	1292.5	1.635	.96716	7.05424	.21892
33	180	2.600	.325	.6500	1286.4	1.625	.96204	7.01689	.23577	1280.8	1.619	.95894	6.99425	.24548	1282.9	1.621	.95999	7.00192	.24223
34	180	2.800	.350	.7000	1270.1	1.604	.95127	6.93834	.26810	1268.0	1.600	.94937	6.92449	.27345	1270.1	1.602	.95043	6.93216	.27049
35	180	3.030	.375	.7500	1256.1	1.580	.93931	6.85107	.30042	1252.1	1.576	.93742	6.83728	.30526	1254.2	1.578	.93847	6.84497	.30257
36	180	3.200	.400	.8000	1233.3	1.549	.92375	6.73761	.33852	1231.3	1.546	.92187	6.72390	.34289	1233.4	1.548	.92293	6.73161	.34044
37	180	3.400	.425	.8500	1203.0	1.505	.90102	6.57179	.38877	1200.9	1.501	.89915	6.55820	.39267	1203.0	1.503	.90021	6.56594	.39045
38	180	3.630	.450	.9000	1159.8	1.441	.86871	6.33615	.45295	1156.2	1.435	.86567	6.31402	.45866	1158.3	1.437	.86674	6.32178	.45666
39	180	3.800	.475	.9500	1086.3	1.333	.81367	5.93468	.55084	1084.4	1.329	.81187	5.92157	.55388	1086.4	1.331	.81294	5.92940	.55207
40	270	1.030	.125	.2500	1327.6	1.689	.99435	7.25253	.09001	1325.5	1.685	.99242	7.23844	.10433	1329.3	1.689	.99466	7.25479	.08750
41	270	2.000	.250	.5000	1306.8	1.658	.97879	7.13908	.17526	1306.3	1.656	.97807	7.13379	.17827	1306.9	1.656	.97792	7.13272	.17887
42	270	3.000	.375	.7500	1254.1	1.580	.93931	6.85107	.30042	1253.6	1.579	.93861	6.84600	.30221	1255.8	1.581	.93967	6.85369	.29949
43	90	1.030	.125	.2500	1329.2	1.691	.99555	7.26126	.07988	1325.5	1.685	.99242	7.23844	.10433	1329.3	1.689	.99466	7.25479	.08750
44	90	2.000	.250	.5000	1313.0	1.663	.98119	7.15653	.16494	1306.3	1.656	.97807	7.13379	.17827	1306.9	1.656	.97792	7.13272	.17887
45	90	3.000	.375	.7500	1254.1	1.580	.93931	6.85107	.30042	1250.5	1.574	.93622	6.82856	.30829	1252.6	1.576	.93727	6.83625	.30562

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE IX.- DATA[a] FOR 180° CONE; $M_\infty = 2.30$ - Continued

(a) $\alpha = 0°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 2292.1 psf					Φ = 90.0°, p_t = 2291.3 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1335.5	1.697	.99887	7.28548	.04026	1335.5	1.698	.99921	7.28802	.03350
2	0	.230	.025	.0500	1333.9	1.695	.99767	7.27676	.05772	1333.9	1.696	.99802	7.27930	.05322
3	0	.400	.050	.1000	1333.9	1.695	.99767	7.27676	.05772	1333.9	1.696	.99802	7.27930	.05322
4	0	.630	.075	.1500	1333.9	1.695	.99767	7.27676	.05772	1333.9	1.696	.99802	7.27930	.05322
5	0	.830	.100	.2000	1330.7	1.690	.99528	7.25933	.08223	1332.3	1.693	.99682	7.27059	.06742
6	0	1.000	.125	.2500	1329.1	1.688	.99409	7.25062	.09208	1330.7	1.691	.99563	7.26187	.07913
7	0	1.230	.150	.3000	1325.9	1.683	.99170	7.23319	.10920	1327.5	1.686	.99324	7.24443	.09849
8	0	1.430	.175	.3500	1322.7	1.679	.98931	7.21576	.12402	1322.7	1.679	.98965	7.21828	.12199
9	0	1.630	.200	.4000	1317.9	1.672	.98572	7.18962	.14347	1319.5	1.675	.98726	7.20084	.13545
10	0	1.830	.225	.4500	1313.1	1.664	.98214	7.16347	.16066	1314.7	1.667	.98368	7.17469	.15351
11	0	2.000	.250	.5000	1306.7	1.655	.97736	7.12861	.18117	1309.9	1.660	.98009	7.14854	.16974
12	0	2.230	.275	.5500	1301.9	1.648	.97377	7.10247	.19521	1301.9	1.649	.97411	7.10495	.19392
13	0	2.400	.300	.6000	1292.3	1.634	.96661	7.05018	.22081	1293.9	1.637	.96814	7.06136	.21557
14	0	2.600	.325	.6500	1281.2	1.617	.95824	6.98918	.24760	1284.3	1.623	.96097	7.00905	.23917
15	0	2.800	.350	.7000	1266.8	1.596	.94749	6.91075	.27866	1270.0	1.602	.95021	6.93059	.27110
16	0	3.030	.375	.7500	1250.8	1.573	.93554	6.82360	.31000	1254.0	1.578	.93826	6.84342	.30311
17	0	3.200	.400	.8000	1233.0	1.542	.92001	6.71031	.34718	1233.2	1.547	.92272	6.73009	.34092
18	0	3.430	.425	.8500	1202.9	1.502	.89970	6.56216	.39154	1204.5	1.505	.90121	6.57317	.38837
19	0	3.630	.450	.9000	1159.7	1.439	.86744	6.32686	.45535	1161.3	1.441	.86893	6.33779	.45253
20	0	3.800	.475	.9500	1084.7	1.328	.81128	5.91727	.55487	1084.7	1.328	.81156	5.91934	.55439
21	180	.230	.025	.0500	1335.5	1.697	.99887	7.28548	.04026	1335.5	1.698	.99921	7.28802	.03350
22	180	.430	.050	.1000	1335.5	1.697	.99887	7.28548	.04026	1335.5	1.698	.99921	7.28802	.03350
23	180	.500	.075	.1500	1332.3	1.693	.99648	7.26805	.07103	1333.9	1.696	.99802	7.27930	.05322
24	180	.800	.100	.2000	1330.7	1.690	.99528	7.25933	.08223	1330.7	1.691	.99563	7.26187	.07913
25	180	1.030	.125	.2500	1329.1	1.688	.99409	7.25062	.09208	1329.1	1.689	.99443	7.25315	.08933
26	180	1.230	.150	.3000	1325.9	1.683	.99170	7.23319	.10920	1325.9	1.684	.99204	7.23572	.10689
27	180	1.400	.175	.3500	1322.7	1.679	.98931	7.21576	.12402	1322.7	1.679	.98965	7.21828	.12199
28	180	1.600	.200	.4000	1319.5	1.674	.98692	7.19833	.13729	1319.5	1.675	.98726	7.20084	.13545
29	180	1.800	.225	.4500	1313.1	1.664	.98214	7.16347	.16066	1314.7	1.667	.98368	7.17469	.15351
30	180	2.030	.250	.5000	1309.9	1.660	.97975	7.14604	.17121	1308.3	1.658	.97830	7.13982	.17483
31	180	2.230	.275	.5500	1301.9	1.648	.97377	7.10247	.19521	1300.3	1.646	.97292	7.09623	.19843
32	180	2.400	.300	.6000	1292.3	1.634	.96661	7.05018	.22081	1292.3	1.635	.96694	7.05264	.21967
33	180	2.630	.325	.6500	1282.8	1.620	.95944	6.99789	.24394	1282.8	1.620	.95977	7.00034	.24290
34	180	2.800	.350	.7000	1268.4	1.599	.94868	6.91946	.27537	1270.0	1.602	.95021	6.93059	.27110
35	180	3.000	.375	.7500	1252.4	1.575	.93674	6.83231	.30699	1252.4	1.576	.93706	6.83470	.30616
36	180	3.200	.400	.8000	1233.2	1.547	.92240	6.72774	.34167	1231.6	1.545	.92152	6.72137	.34369
37	180	3.400	.425	.8500	1202.9	1.502	.89970	6.56216	.39154	1201.3	1.500	.89882	6.55573	.39337
38	180	3.600	.450	.9000	1158.1	1.436	.86624	6.31815	.45760	1156.6	1.434	.86535	6.31164	.45927
39	180	3.800	.475	.9500	1086.3	1.330	.81247	5.92599	.55286	1084.7	1.328	.81156	5.91934	.55439
40	270	1.030	.125	.2500	1329.1	1.688	.99409	7.25062	.09208	1329.1	1.689	.99443	7.25315	.08933
41	270	2.000	.250	.5000	1309.9	1.660	.97975	7.14604	.17121	1309.9	1.660	.98009	7.14854	.16974
42	270	3.030	.375	.7500	1254.0	1.577	.93793	6.84103	.30395	1255.6	1.580	.93945	6.85214	.30004
43	90	1.030	.125	.2500	1329.1	1.688	.99409	7.25062	.09208	1329.1	1.689	.99443	7.25315	.08933
44	90	2.000	.250	.5000	1308.3	1.657	.97855	7.13733	.17626	1308.3	1.658	.97890	7.13982	.17483
45	90	3.030	.375	.7500	1252.4	1.575	.93674	6.83231	.30699	1254.0	1.578	.93826	6.84342	.30311

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE IX.- DATA[a] FOR 180° CONE; M_∞ = 2.30 - Continued

(b) α = 5°

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 2289.4 psf					Φ = 22.5°, p_t = 2290.3 psf					Φ = 45.0°, p_t = 2290.5 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1328.7	1.690	.99498	7.25715	.08480	1330.6	1.692	.99599	7.26453	.07574	1329.0	1.689	.99471	7.25518	.08706
2	0	.200	.025	.0500	1328.7	1.690	.99498	7.25715	.08480	1327.4	1.687	.99360	7.24709	.09579	1327.4	1.687	.99352	7.24646	.09644
3	0	.400	.050	.1000	1325.5	1.685	.99259	7.23971	.10313	1327.4	1.687	.99360	7.24709	.09579	1325.8	1.685	.99232	7.23774	.10500
4	0	.600	.075	.1500	1323.9	1.683	.99139	7.23099	.11118	1325.8	1.685	.99241	7.23837	.10440	1325.8	1.685	.99232	7.23774	.10500
5	0	.930	.100	.2000	1320.7	1.678	.98900	7.21354	.12578	1322.6	1.680	.99002	7.22093	.11981	1321.0	1.677	.98873	7.21158	.12732
6	0	1.030	.125	.2500	1317.5	1.673	.98661	7.19610	.13890	1317.8	1.673	.98643	7.19477	.13985	1319.4	1.675	.98754	7.20286	.13396
7	0	1.200	.150	.3000	1312.7	1.666	.98302	7.16993	.15659	1313.0	1.666	.98284	7.16860	.15743	1314.6	1.668	.98395	7.17670	.15220
8	0	1.430	.175	.3500	1307.9	1.659	.97944	7.14376	.17254	1308.2	1.659	.97926	7.14244	.17331	1309.8	1.661	.98037	7.15054	.16855
9	0	1.600	.200	.4000	1301.6	1.650	.97465	7.10887	.19187	1303.4	1.652	.97557	7.11628	.18792	1305.0	1.654	.97678	7.12438	.18351
10	0	1.830	.225	.4500	1293.6	1.638	.96867	7.06526	.21372	1295.4	1.640	.96969	7.07267	.21015	1298.6	1.644	.97200	7.08950	.20184
11	0	2.000	.250	.5000	1287.2	1.629	.96389	7.03037	.22982	1289.1	1.631	.96491	7.03779	.22648	1292.2	1.635	.96721	7.05462	.21875
12	0	2.200	.275	.5500	1279.2	1.617	.95791	6.98675	.24862	1279.5	1.616	.95773	6.98546	.24915	1282.7	1.621	.96004	7.00230	.24207
13	0	2.400	.300	.6000	1266.4	1.598	.94834	6.91697	.27631	1266.7	1.598	.94817	6.91570	.27679	1273.1	1.607	.95287	6.94997	.26353
14	0	2.630	.325	.6500	1253.6	1.579	.93878	6.84719	.30179	1257.1	1.583	.94099	6.86337	.29605	1261.9	1.590	.94450	6.88893	.28678
15	0	2.800	.350	.7000	1240.9	1.560	.92921	6.77741	.32557	1241.1	1.560	.92904	6.77616	.32598	1247.5	1.569	.93374	6.81045	.31450
16	0	3.030	.375	.7500	1221.7	1.532	.91486	6.67274	.35842	1222.0	1.532	.91469	6.67151	.35920	1228.4	1.541	.91939	6.70581	.34859
17	0	3.230	.400	.8000	1197.8	1.497	.89692	6.54190	.39731	1198.0	1.496	.89675	6.54070	.39765	1206.0	1.508	.90265	6.58373	.38532
18	0	3.430	.425	.8500	1165.8	1.449	.87300	6.36745	.44479	1157.7	1.452	.87404	6.37500	.44281	1175.6	1.463	.87994	6.41804	.43139
19	0	3.630	.450	.9000	1121.1	1.384	.83952	6.12322	.50621	1124.5	1.388	.84175	6.13953	.50225	1130.9	1.397	.84646	6.17388	.49385
20	0	3.800	.475	.9500	1046.0	1.273	.78331	5.71326	.60113	1049.4	1.277	.78556	5.72965	.59747	1055.8	1.287	.79027	5.76403	.58976
21	180	.200	.025	.0500	1333.5	1.697	.99857	7.28332	.04521	1333.8	1.696	.99839	7.28198	.04804	1332.2	1.694	.99710	7.27262	.06439
22	180	.400	.050	.1000	1333.5	1.697	.99857	7.28332	.04521	1335.4	1.699	.99958	7.29070	.02445	1332.2	1.694	.99710	7.27262	.06439
23	180	.630	.075	.1500	1333.5	1.697	.99857	7.28332	.04521	1335.4	1.699	.99958	7.29070	.02445	1332.2	1.694	.99710	7.27262	.06439
24	180	.800	.100	.2000	1333.5	1.697	.99857	7.28332	.04521	1335.4	1.699	.99958	7.29070	.02445	1332.2	1.694	.99710	7.27262	.06439
25	180	1.000	.125	.2500	1333.5	1.697	.99857	7.28332	.04521	1335.4	1.699	.99958	7.29070	.02445	1332.2	1.694	.99710	7.27262	.06439
26	180	1.230	.150	.3000	1333.5	1.697	.99857	7.28332	.04521	1333.8	1.696	.99839	7.28198	.04804	1330.6	1.692	.99591	7.26390	.07656
27	180	1.400	.175	.3500	1331.9	1.694	.99737	7.27460	.06130	1333.8	1.696	.99839	7.28198	.04804	1329.0	1.689	.99471	7.25518	.08706
28	180	1.600	.200	.4000	1330.3	1.692	.99618	7.26588	.07398	1330.6	1.692	.99599	7.26453	.07574	1325.8	1.685	.99232	7.23774	.10500
29	180	1.830	.225	.4500	1327.1	1.687	.99379	7.24843	.09440	1329.0	1.689	.99480	7.25581	.08634	1322.6	1.680	.98993	7.22030	.12033
30	180	2.000	.250	.5000	1323.9	1.683	.99139	7.23099	.11118	1325.8	1.685	.99241	7.23837	.10440	1319.4	1.675	.98754	7.20286	.13396
31	180	2.200	.275	.5500	1319.1	1.676	.98781	7.20482	.13250	1319.4	1.675	.98762	7.20349	.13349	1313.0	1.666	.98276	7.16798	.15783
32	180	2.400	.300	.6000	1312.7	1.666	.98302	7.16993	.15659	1313.0	1.666	.98284	7.16860	.15743	1306.6	1.656	.97797	7.13310	.17866
33	180	2.600	.325	.6500	1306.3	1.657	.97824	7.13504	.17756	1306.6	1.656	.97806	7.13372	.17831	1298.6	1.644	.97200	7.08950	.20184
34	180	2.800	.350	.7000	1296.8	1.643	.97106	7.08270	.20524	1295.4	1.640	.96969	7.07267	.21015	1287.5	1.628	.96363	7.02846	.23067
35	180	3.030	.375	.7500	1284.0	1.624	.96150	7.01292	.23750	1282.7	1.621	.96032	7.00291	.24181	1274.7	1.609	.95406	6.95869	.26006
36	180	3.230	.400	.8000	1266.4	1.598	.94834	6.91697	.27631	1263.5	1.593	.94578	6.89826	.28334	1255.5	1.581	.93972	6.85405	.29936
37	180	3.400	.425	.8500	1239.3	1.558	.92801	6.76869	.32844	1237.9	1.555	.92665	6.75872	.33170	1228.4	1.541	.91939	6.70581	.34859
38	180	3.600	.450	.9000	1199.3	1.499	.89812	6.55063	.39483	1194.8	1.492	.89436	6.52326	.40257	1183.6	1.475	.88592	6.46164	.41962
39	180	3.800	.475	.9500	1127.5	1.393	.84430	6.15811	.49772	1124.5	1.388	.84175	6.13953	.50225	1113.3	1.371	.83331	6.07796	.51711
40	270	1.000	.125	.2500	1325.5	1.685	.99259	7.23971	.10313	1329.0	1.689	.99480	7.25581	.08634	1332.2	1.694	.99710	7.27262	.06439
41	270	2.000	.250	.5000	1303.2	1.652	.97585	7.11759	.18721	1311.4	1.663	.98165	7.15988	.16289	1317.8	1.673	.98634	7.19414	.14030
42	270	3.000	.375	.7500	1250.5	1.574	.93638	6.82975	.30787	1261.9	1.590	.94458	6.88953	.28656	1274.7	1.609	.95406	6.95869	.26006
43	90	1.000	.125	.2500	1327.1	1.687	.99379	7.24843	.09440	1324.2	1.682	.99121	7.22965	.11236	1319.4	1.675	.98754	7.20286	.13396
44	90	2.000	.250	.5000	1304.8	1.654	.97704	7.12631	.18245	1297.0	1.642	.97089	7.08139	.20588	1292.2	1.635	.96721	7.05462	.21875
45	90	3.000	.375	.7500	1248.9	1.572	.93519	6.82103	.31088	1236.3	1.553	.92545	6.75000	.33453	1229.9	1.543	.92059	6.71453	.34585

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE IX.- DATA[a] FOR 180° CONE; $M_\infty = 2.30$ - Continued

(b) $\alpha = 5°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 2292.3 psf					Φ = 90.0°, p_t = 2292.0 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1329.2	1.688	.99407	7.25049	.09222	1330.7	1.690	.99533	7.25965	.08185
2	0	.200	.025	.0500	1329.2	1.688	.99407	7.25049	.09222	1329.1	1.688	.99413	7.25094	.09175
3	0	.400	.050	.1000	1327.6	1.686	.99287	7.24178	.10113	1329.1	1.688	.99413	7.25094	.09175
4	0	.600	.075	.1500	1327.6	1.686	.99287	7.24178	.10113	1330.7	1.690	.99533	7.25965	.08185
5	0	.800	.100	.2000	1326.0	1.683	.99168	7.23306	.10932	1329.1	1.688	.99413	7.25094	.09175
6	0	1.000	.125	.2500	1322.8	1.679	.98929	7.21563	.12412	1325.9	1.683	.99174	7.23351	.10891
7	0	1.200	.150	.3000	1318.0	1.671	.98571	7.18949	.14356	1322.7	1.679	.98935	7.21608	.12377
8	0	1.400	.175	.3500	1314.8	1.667	.98332	7.17206	.15522	1319.5	1.674	.98696	7.19865	.13706
9	0	1.600	.200	.4000	1310.0	1.660	.97973	7.14592	.17128	1314.7	1.667	.98338	7.17250	.15494
10	0	1.800	.225	.4500	1303.6	1.650	.97495	7.11106	.19071	1309.9	1.660	.97979	7.14635	.17103
11	0	2.000	.250	.5000	1298.8	1.643	.97137	7.08491	.20414	1305.1	1.653	.97621	7.12021	.18579
12	0	2.200	.275	.5500	1292.4	1.634	.96659	7.05006	.22087	1297.1	1.641	.97023	7.07663	.20822
13	0	2.400	.300	.6000	1282.8	1.620	.95942	6.99777	.24399	1290.7	1.632	.96545	7.04177	.22467
14	0	2.600	.325	.6500	1270.1	1.601	.94986	6.92805	.27208	1278.0	1.613	.95589	6.97205	.25467
15	0	2.800	.350	.7000	1254.1	1.577	.93791	6.84091	.30399	1265.2	1.594	.94634	6.90233	.28182
16	0	3.000	.375	.7500	1238.1	1.554	.92597	6.75376	.33332	1249.2	1.570	.93439	6.81518	.31288
17	0	3.200	.400	.8000	1217.3	1.523	.91043	6.64047	.36859	1228.4	1.540	.91885	6.70189	.34982
18	0	3.400	.425	.8500	1187.0	1.479	.88773	6.47490	.41599	1199.7	1.497	.89735	6.54502	.39643
19	0	3.600	.450	.9000	1143.9	1.415	.85547	6.23960	.47754	1156.6	1.434	.86508	6.30971	.45977
20	0	3.800	.475	.9500	1068.8	1.304	.79932	5.83002	.57485	1081.5	1.323	.80893	5.90010	.55883
21	180	.200	.025	.0500	1332.4	1.693	.99646	7.26792	.07121	1330.7	1.690	.99533	7.25965	.08185
22	180	.400	.050	.1000	1332.4	1.693	.99646	7.26792	.07121	1330.7	1.690	.99533	7.25965	.08185
23	180	.600	.075	.1500	1330.8	1.690	.99526	7.25920	.08238	1327.5	1.686	.99294	7.24222	.10069
24	180	.800	.100	.2000	1330.8	1.690	.99526	7.25920	.08238	1327.5	1.686	.99294	7.24222	.10069
25	180	1.000	.125	.2500	1329.2	1.688	.99407	7.25049	.09222	1325.9	1.683	.99174	7.23351	.10891
26	180	1.200	.150	.3000	1326.0	1.683	.99168	7.23306	.10932	1322.7	1.679	.98935	7.21608	.12377
27	180	1.400	.175	.3500	1326.0	1.683	.99168	7.23306	.10932	1319.5	1.674	.98696	7.19865	.13706
28	180	1.600	.200	.4000	1321.2	1.676	.98810	7.20692	.13091	1313.1	1.665	.98218	7.16378	.16047
29	180	1.800	.225	.4500	1318.0	1.671	.98571	7.18949	.14356	1309.9	1.660	.97979	7.14635	.17103
30	180	2.000	.250	.5000	1313.2	1.664	.98212	7.16334	.16074	1301.9	1.648	.97382	7.10278	.19505
31	180	2.200	.275	.5500	1308.4	1.657	.97854	7.13720	.17633	1297.1	1.641	.97023	7.07663	.20822
32	180	2.400	.300	.6000	1298.8	1.643	.97137	7.08491	.20414	1287.5	1.627	.96306	7.02434	.23250
33	180	2.600	.325	.6500	1287.6	1.627	.96300	7.02391	.23269	1276.4	1.610	.95470	6.96334	.25820
34	180	2.800	.350	.7000	1276.4	1.610	.95564	6.96291	.25837	1263.6	1.592	.94514	6.89362	.28505
35	180	3.000	.375	.7500	1262.1	1.589	.94389	6.88448	.28841	1247.6	1.568	.93319	6.80647	.31585
36	180	3.200	.400	.8000	1242.9	1.561	.92955	6.77991	.32475	1226.8	1.537	.91766	6.69317	.35253
37	180	3.400	.425	.8500	1214.1	1.519	.90804	6.62304	.37379	1198.1	1.495	.89615	6.53630	.39889
38	180	3.600	.450	.9000	1169.4	1.453	.87459	6.37904	.44175	1151.8	1.427	.86150	6.28356	.46645
39	180	3.800	.475	.9500	1097.5	1.347	.82082	5.98688	.53868	1079.9	1.321	.80773	5.89139	.56083
40	270	1.000	.125	.2500	1332.4	1.693	.99646	7.26792	.07121	1333.9	1.695	.99771	7.27708	.05718
41	270	2.000	.250	.5000	1324.4	1.681	.99048	7.22435	.11695	1324.3	1.681	.99055	7.22479	.11657
42	270	3.000	.375	.7500	1279.6	1.615	.95703	6.98034	.25127	1282.8	1.620	.95948	6.99820	.24381
43	90	1.000	.125	.2500	1318.0	1.671	.98571	7.18949	.14356	1317.9	1.672	.98577	7.18993	.14326
44	90	2.000	.250	.5000	1292.4	1.634	.96659	7.05006	.22087	1287.5	1.627	.96306	7.02434	.23250
45	90	3.000	.375	.7500	1225.3	1.535	.91641	6.68405	.35535	1220.4	1.528	.91288	6.65831	.36322

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE IX.- DATA[a] FOR 180° CONE; $M_\infty = 2.30$ - Continued

(c) $\alpha = 10°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 2289.3 psf					Φ = 22.5°, p_t = 2291.7 psf					Φ = 45.0°, p_t = 2291.1 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1319.2	1.676	.98789	7.20541	.13206	1319.6	1.674	.98716	7.20009	.13601	1319.8	1.675	.98755	7.20297	.13388
2	0	.200	.025	.0500	1316.0	1.671	.98549	7.18794	.14464	1314.8	1.667	.98357	7.17394	.15400	1316.6	1.670	.98516	7.18553	.14629
3	0	.400	.050	.1000	1311.2	1.664	.98190	7.16174	.16174	1313.2	1.665	.98238	7.16522	.15957	1315.0	1.668	.98397	7.17681	.15213
4	0	.600	.075	.1500	1306.4	1.657	.97831	7.13554	.17728	1308.4	1.658	.97879	7.13907	.17526	1313.4	1.666	.98277	7.16809	.15776
5	0	.800	.100	.2000	1303.2	1.652	.97591	7.11807	.18695	1305.2	1.653	.97640	7.12164	.18502	1308.6	1.659	.97919	7.14193	.17361
6	0	1.000	.125	.2500	1296.8	1.643	.97112	7.08313	.20502	1298.8	1.644	.97162	7.08677	.20321	1303.8	1.652	.97560	7.11577	.18819
7	0	1.200	.150	.3000	1292.0	1.636	.96753	7.05693	.21766	1292.4	1.634	.96684	7.05190	.22001	1295.8	1.640	.96962	7.07217	.21040
8	0	1.400	.175	.3500	1286.0	1.624	.96154	7.01326	.23735	1286.0	1.625	.96206	7.01703	.23571	1291.0	1.633	.96603	7.04601	.22273
9	0	1.600	.200	.4000	1276.0	1.612	.95556	6.96959	.25567	1276.4	1.611	.95489	6.96473	.25764	1284.6	1.623	.96125	7.01113	.23828
10	0	1.800	.225	.4500	1266.4	1.598	.94837	6.91719	.27623	1268.5	1.599	.94892	6.92115	.27472	1276.6	1.612	.95527	6.96753	.25651
11	0	2.000	.250	.5000	1256.8	1.584	.94119	6.86479	.29556	1260.6	1.587	.94294	6.87757	.29093	1268.6	1.600	.94930	6.92392	.27366
12	0	2.200	.275	.5500	1248.8	1.572	.93520	6.82112	.31085	1250.9	1.573	.93577	6.82526	.30942	1257.5	1.583	.94093	6.86288	.29622
13	0	2.400	.300	.6000	1234.4	1.551	.92442	6.74251	.33695	1238.1	1.554	.92521	6.75553	.33274	1246.3	1.567	.93256	6.80184	.31741
14	0	2.600	.325	.6500	1221.6	1.532	.91484	6.67264	.35885	1225.3	1.535	.91665	6.68580	.35481	1231.9	1.546	.92180	6.72336	.34306
15	0	2.800	.350	.7000	1202.4	1.504	.90047	6.56784	.38991	1207.8	1.510	.90350	6.58991	.38352	1217.5	1.524	.91104	6.64487	.36727
16	0	3.000	.375	.7500	1183.3	1.475	.88611	6.46303	.41924	1187.0	1.479	.88796	6.47659	.41553	1198.3	1.496	.89669	6.54023	.39778
17	0	3.200	.400	.8000	1159.3	1.440	.86814	6.33202	.45402	1154.6	1.446	.87123	6.35456	.44816	1172.8	1.458	.87756	6.40071	.43602
18	0	3.400	.425	.8500	1125.7	1.390	.84300	6.14861	.50004	1132.7	1.399	.84733	6.18022	.49229	1142.4	1.414	.85484	6.23502	.47469
19	0	3.600	.450	.9000	1082.5	1.327	.81067	5.91280	.55590	1086.3	1.331	.81267	5.92743	.55252	1099.3	1.350	.82256	5.99957	.53570
20	0	3.800	.475	.9500	1009.0	1.218	.75558	5.51104	.64563	1011.3	1.220	.75650	5.51774	.64418	1024.2	1.239	.76637	5.58972	.62845
21	180	.200	.025	.0500	1327.3	1.688	.99397	7.24975	.09301	1326.0	1.684	.99194	7.23495	.10759	1326.2	1.685	.99234	7.23786	.10489
22	180	.400	.050	.1000	1327.3	1.688	.99397	7.24975	.09301	1329.2	1.688	.99433	7.25239	.09017	1327.8	1.687	.99353	7.24658	.09632
23	180	.600	.075	.1500	1332.1	1.695	.99756	7.27593	.05913	1330.8	1.691	.99552	7.26111	.08007	1329.4	1.689	.99473	7.25530	.08693
24	180	.800	.100	.2000	1333.7	1.697	.99875	7.28465	.04223	1332.4	1.693	.99672	7.26982	.06853	1329.4	1.689	.99473	7.25530	.08693
25	180	1.000	.125	.2500	1335.3	1.700	.99995	7.29338	.00855	1334.0	1.696	.99791	7.27854	.05462	1329.4	1.689	.99473	7.25530	.08693
26	180	1.200	.150	.3000	1336.9	1.702	1.00114	7.30210	.00000	1335.6	1.698	.99911	7.28726	.03567	1329.4	1.689	.99473	7.25530	.08693
27	180	1.400	.175	.3500	1338.5	1.704	1.00234	7.31082	.00000	1335.6	1.698	.99911	7.28726	.03567	1329.4	1.689	.99473	7.25530	.08693
28	180	1.600	.200	.4000	1338.5	1.704	1.00234	7.31082	.00000	1335.6	1.698	.99911	7.28726	.03567	1329.4	1.689	.99473	7.25530	.08693
29	180	1.800	.225	.4500	1338.5	1.704	1.00234	7.31082	.00000	1335.6	1.698	.99911	7.28726	.03567	1329.4	1.689	.99473	7.25530	.08693
30	180	2.000	.250	.5000	1336.9	1.702	1.00114	7.30210	.00000	1334.0	1.696	.99791	7.27854	.05462	1327.8	1.687	.99353	7.24658	.09632
31	180	2.200	.275	.5500	1335.3	1.700	.99995	7.29338	.00855	1332.4	1.693	.99672	7.26982	.06853	1324.6	1.682	.99114	7.22913	.11282
32	180	2.400	.300	.6000	1333.7	1.697	.99875	7.28465	.04223	1329.2	1.688	.99433	7.25239	.09017	1319.8	1.675	.98755	7.20297	.13388
33	180	2.600	.325	.6500	1327.3	1.688	.99397	7.24975	.09301	1322.8	1.679	.98955	7.21752	.12260	1316.6	1.670	.98516	7.18553	.14629
34	180	2.800	.350	.7000	1319.3	1.676	.98799	7.20613	.13151	1316.4	1.670	.98477	7.18245	.14824	1313.2	1.661	.98038	7.15065	.16848
35	180	3.000	.375	.7500	1309.7	1.662	.98081	7.15379	.16660	1303.6	1.651	.97521	7.11292	.18972	1303.6	1.647	.97321	7.09833	.19735
36	180	3.200	.400	.8000	1295.3	1.641	.97005	7.07527	.20889	1290.8	1.632	.96565	7.04319	.22403	1287.8	1.628	.96364	7.02857	.23062
37	180	3.400	.425	.8500	1271.4	1.605	.95210	6.94441	.26572	1266.9	1.597	.94772	6.91243	.27803	1271.8	1.604	.95169	6.94136	.26692
38	180	3.600	.450	.9000	1236.3	1.553	.92579	6.75248	.33373	1230.1	1.543	.92023	6.71195	.34667	1247.9	1.569	.93375	6.81056	.31446
39	180	3.800	.475	.9500	1167.6	1.452	.87436	6.37734	.44219	1159.8	1.439	.86765	6.32841	.45495	1207.9	1.510	.90386	6.59255	.38275
40	270	1.000	.125	.2500	1316.1	1.671	.98560	7.18869	.14412	1322.8	1.679	.98955	7.21752	.12260	1329.4	1.689	.99473	7.25530	.08693
41	270	2.000	.250	.5000	1293.8	1.638	.96885	7.06655	.21310	1310.0	1.660	.97999	7.14779	.17018	1324.6	1.682	.99114	7.22913	.11282
42	270	3.000	.375	.7500	1239.4	1.558	.92818	6.76993	.32804	1255.9	1.597	.96772	6.91243	.27803	1287.8	1.628	.96364	7.02857	.23062
43	90	1.000	.125	.2500	1314.4	1.669	.98430	7.17921	.15055	1306.8	1.656	.97760	7.13035	.18020	1300.6	1.647	.97321	7.09833	.19735
44	90	2.000	.250	.5000	1295.2	1.640	.96993	7.07440	.20931	1278.0	1.613	.95609	6.97345	.25410	1267.0	1.597	.94810	6.91520	.27698
45	90	3.000	.375	.7500	1239.2	1.558	.92802	6.76872	.32844	1217.3	1.524	.91067	6.64221	.36807	1198.3	1.496	.89669	6.54023	.39778

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE IX.- DATA[a] FOR 180° CONE; $M_\infty = 2.30$ - Continued

(c) $\alpha = 10°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 2292.3 psf					Φ = 90.0°, p_t = 2290.8 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.030	.000	.0000	1319.2	1.673	.98663	7.19620	.13882	1321.0	1.677	.98850	7.21063	.12806
2	0	.200	.025	.0500	1317.6	1.671	.98543	7.18749	.14494	1321.0	1.677	.98860	7.21063	.12806
3	0	.430	.050	.1000	1317.6	1.671	.98543	7.18749	.14494	1321.0	1.677	.98860	7.21063	.12806
4	0	.630	.075	.1500	1314.4	1.666	.98304	7.17007	.15650	1321.0	1.677	.98860	7.21063	.12806
5	0	.830	.100	.2000	1312.8	1.664	.98185	7.16135	.16198	1317.8	1.672	.98621	7.19320	.14096
6	0	1.000	.125	.2500	1308.0	1.657	.97826	7.13522	.17746	1316.2	1.670	.98502	7.18448	.14701
7	0	1.200	.150	.3000	1303.2	1.650	.97468	7.10908	.19175	1313.0	1.665	.98263	7.16704	.15842
8	0	1.400	.175	.3500	1300.1	1.645	.97229	7.09166	.20075	1309.8	1.661	.98024	7.14960	.16911
9	0	1.630	.200	.4000	1293.7	1.636	.96751	7.05681	.21772	1306.6	1.656	.97785	7.13216	.17918
10	0	1.800	.225	.4500	1288.9	1.629	.96393	7.03067	.22969	1303.2	1.647	.97306	7.09729	.19789
11	0	2.000	.250	.5000	1279.3	1.614	.95676	6.97840	.25207	1295.4	1.640	.96948	7.07113	.21090
12	0	2.230	.275	.5500	1271.3	1.603	.95079	6.93484	.26946	1287.5	1.628	.96350	7.02754	.23108
13	0	2.400	.300	.6000	1260.1	1.586	.94243	6.87385	.29228	1277.9	1.614	.95633	6.97522	.25338
14	0	2.600	.325	.6500	1248.9	1.570	.93407	6.81287	.31367	1266.7	1.597	.94796	6.91419	.27737
15	0	2.830	.350	.7000	1234.6	1.549	.92332	6.73446	.33953	1255.5	1.581	.93959	6.85315	.29968
16	0	3.000	.375	.7500	1215.4	1.520	.90899	6.62992	.37175	1236.3	1.552	.92525	6.74853	.33501
17	0	3.230	.400	.8000	1194.6	1.490	.89346	6.51666	.40442	1215.6	1.522	.90971	6.63518	.37018
18	0	3.400	.425	.8500	1152.7	1.443	.86957	6.34242	.45132	1188.4	1.482	.88939	6.48696	.41267
19	0	3.600	.450	.9000	1119.6	1.379	.83732	6.10719	.51009	1146.9	1.421	.85831	6.26026	.47235
20	0	3.800	.475	.9500	1044.5	1.269	.78118	5.69772	.60459	1073.4	1.312	.80332	5.85919	.56821
21	180	.230	.025	.0500	1322.4	1.678	.98902	7.21363	.12572	1322.6	1.680	.98980	7.21935	.12111
22	180	.430	.050	.1000	1324.0	1.680	.99021	7.22234	.11864	1321.0	1.677	.98860	7.21063	.12806
23	180	.630	.075	.1500	1322.4	1.678	.98902	7.21363	.12572	1319.4	1.675	.98741	7.20192	.13466
24	180	.800	.100	.2000	1322.4	1.678	.98902	7.21363	.12572	1316.2	1.670	.98502	7.18448	.14701
25	180	1.000	.125	.2500	1322.4	1.678	.98902	7.21363	.12572	1314.6	1.668	.98382	7.17576	.15282
26	180	1.230	.150	.3000	1320.8	1.676	.98782	7.20491	.13243	1311.4	1.663	.98143	7.15832	.16385
27	180	1.430	.175	.3500	1319.2	1.673	.98663	7.19620	.13882	1308.2	1.658	.97904	7.14088	.17421
28	180	1.600	.200	.4000	1317.6	1.671	.98543	7.18749	.14494	1303.4	1.651	.97546	7.11473	.18875
29	180	1.800	.225	.4500	1314.4	1.666	.98304	7.17007	.15650	1298.6	1.644	.97187	7.08857	.20231
30	180	2.030	.250	.5000	1309.6	1.659	.97946	7.14393	.17245	1293.8	1.637	.96828	7.06241	.21507
31	180	2.230	.275	.5500	1304.8	1.652	.97588	7.11779	.18710	1287.5	1.628	.96350	7.02754	.23108
32	180	2.400	.300	.6000	1298.5	1.643	.97110	7.08295	.20512	1279.5	1.616	.95752	6.98394	.24978
33	180	2.630	.325	.6500	1290.5	1.631	.96513	7.03938	.22576	1268.3	1.599	.94916	6.92291	.27405
34	180	2.800	.350	.7000	1279.3	1.614	.95676	6.97840	.25207	1255.5	1.581	.93959	6.85315	.29968
35	180	3.000	.375	.7500	1264.9	1.593	.94601	6.89999	.28269	1237.9	1.555	.92644	6.75725	.33218
36	180	3.200	.400	.8000	1247.3	1.567	.93288	6.80416	.31663	1217.2	1.524	.91090	6.64390	.36757
37	180	3.430	.425	.8500	1218.6	1.525	.91137	6.64734	.36653	1188.4	1.482	.88939	6.48696	.41267
38	180	3.600	.450	.9000	1177.1	1.464	.88032	6.42082	.43065	1163.7	1.446	.85591	6.24282	.47674
39	180	3.830	.475	.9500	1105.2	1.358	.82657	6.02878	.52881	1071.8	1.310	.80212	5.85047	.57020
40	270	1.000	.125	.2500	1335.2	1.697	.99857	7.28332	.04521	1335.4	1.698	.99936	7.28911	.03016
41	270	2.000	.250	.5000	1333.6	1.694	.99738	7.27461	.06127	1337.0	1.701	1.00056	7.29782	.00000
42	270	3.000	.375	.7500	1306.4	1.654	.97707	7.12651	.18234	1309.8	1.661	.98024	7.14960	.16911
43	90	1.000	.125	.2500	1298.5	1.643	.97110	7.08295	.20512	1297.0	1.642	.97067	7.07985	.20665
44	90	2.000	.250	.5000	1258.5	1.584	.94124	6.86514	.29541	1257.1	1.583	.94079	6.86187	.29658
45	90	3.000	.375	.7500	1186.7	1.478	.88749	6.47310	.41648	1182.0	1.472	.88460	6.45208	.42222

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE IX.- DATA[a] FOR 180° CONE; $M_\infty = 2.30$ - Continued

(d) $\alpha = 15°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 2290.8 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1302.2	1.650	.97455	7.10814	.19225
2	0	.230	.025	.0500	1297.4	1.642	.97096	7.08194	.20562
3	0	.430	.050	.1000	1291.0	1.633	.96617	7.04701	.22227
4	0	.630	.075	.1500	1286.2	1.626	.96258	7.02081	.23406
5	0	.800	.100	.2000	1276.6	1.612	.95540	6.96842	.25615
6	0	1.000	.125	.2500	1270.2	1.602	.95061	6.93349	.26998
7	0	1.230	.150	.3000	1263.8	1.593	.94582	6.89856	.28322
8	0	1.400	.175	.3500	1254.2	1.579	.93863	6.84616	.30215
9	0	1.630	.200	.4000	1246.2	1.567	.93265	6.80250	.31719
10	0	1.800	.225	.4500	1235.0	1.550	.92427	6.74138	.33731
11	0	2.030	.250	.5000	1225.4	1.536	.91708	6.68898	.35383
12	0	2.200	.275	.5500	1212.6	1.517	.90751	6.61912	.37495
13	0	2.400	.300	.6000	1198.2	1.496	.89673	6.54053	.39770
14	0	2.630	.325	.6500	1182.2	1.473	.88476	6.45321	.42191
15	0	2.830	.350	.7000	1164.6	1.447	.87159	6.35715	.44749
16	0	3.030	.375	.7500	1143.8	1.416	.85603	6.24363	.47653
17	0	3.200	.400	.8000	1116.6	1.376	.83567	6.09518	.51298
18	0	3.400	.425	.8500	1084.6	1.329	.81173	5.92054	.55412
19	0	3.630	.450	.9000	1041.5	1.265	.77940	5.68476	.60747
20	0	3.800	.475	.9500	969.5	1.159	.72553	5.29181	.69285
21	180	.230	.025	.0500	1312.0	1.664	.98184	7.16130	.16201
22	180	.430	.050	.1000	1315.2	1.669	.98423	7.17875	.15085
23	180	.630	.075	.1500	1318.4	1.673	.98663	7.19620	.13883
24	180	.800	.100	.2000	1319.9	1.676	.98782	7.20492	.13242
25	180	1.000	.125	.2500	1326.3	1.685	.99260	7.23981	.10303
26	180	1.200	.150	.3000	1329.5	1.690	.99500	7.25725	.08468
27	180	1.400	.175	.3500	1332.7	1.694	.99739	7.27470	.06113
28	180	1.630	.200	.4000	1335.9	1.699	.99978	7.29214	.01772
29	180	1.830	.225	.4500	1339.1	1.704	1.00217	7.30959	.00000
30	180	2.030	.250	.5000	1340.7	1.706	1.00337	7.31831	.00000
31	180	2.200	.275	.5500	1340.7	1.706	1.00337	7.31831	.00000
32	180	2.430	.300	.6000	1340.7	1.706	1.00337	7.31831	.00000
33	180	2.600	.325	.6500	1339.1	1.704	1.00217	7.30959	.00000
34	180	2.830	.350	.7000	1335.9	1.699	.99978	7.29214	.01772
35	180	3.300	.375	.7500	1329.5	1.690	.99500	7.25725	.08468
36	180	3.230	.400	.8000	1319.9	1.676	.98782	7.20492	.13242
37	180	3.400	.425	.8500	1302.4	1.650	.97467	7.10897	.19181
38	180	3.630	.450	.9000	1272.0	1.605	.95194	6.94324	.26618
39	180	3.800	.475	.9500	1211.3	1.515	.90650	6.61178	.37712
40	270	1.030	.125	.2500	1296.0	1.640	.96988	7.07408	.20947
41	270	2.000	.250	.5000	1278.4	1.614	.95673	6.97813	.25218
42	270	3.000	.375	.7500	1225.7	1.537	.91726	6.69028	.35342
43	90	1.030	.125	.2500	1295.8	1.640	.96976	7.07321	.20989
44	90	2.000	.250	.5000	1276.6	1.612	.95540	6.96842	.25615
45	90	3.030	.375	.7500	1222.2	1.532	.91469	6.67152	.35920

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE IX.- DATA[a] FOR 180° CONE; $M_\infty = 2.30$ - Continued

(e) $\alpha = 20°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 2289.8 psf					Φ = 22.5°, p_t = 2291.1 psf					Φ = 45.0°, p_t = 2291.6 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1270.3	1.603	.95110	6.93706	.26859	1272.0	1.605	.95182	6.94233	.26654	1270.3	1.602	.95035	6.93161	.27071
2	0	.230	.025	.0500	1265.5	1.596	.94751	6.91088	.27861	1265.6	1.595	.94704	6.90744	.27991	1267.1	1.597	.94796	6.91418	.27737
3	0	.430	.050	.1000	1259.1	1.587	.94272	6.87598	.29151	1259.2	1.586	.94225	6.87256	.29274	1262.3	1.590	.94437	6.88802	.28712
4	0	.630	.075	.1500	1251.1	1.575	.93674	6.83235	.30697	1251.2	1.574	.93627	6.82895	.30815	1257.5	1.583	.94079	6.86186	.29659
5	0	.830	.100	.2000	1243.2	1.563	.93076	6.78872	.32181	1244.8	1.565	.93149	6.79406	.32003	1251.1	1.574	.93601	6.82699	.30883
6	0	1.000	.125	.2500	1233.6	1.549	.92358	6.73637	.33892	1236.9	1.553	.92551	6.75046	.33639	1244.8	1.564	.93122	6.79211	.32068
7	0	1.230	.150	.3000	1225.6	1.537	.91760	6.69274	.35266	1228.9	1.541	.91953	6.70685	.34826	1236.8	1.552	.92525	6.74851	.33501
8	0	1.400	.175	.3500	1216.0	1.523	.91042	6.64038	.36862	1220.9	1.529	.91356	6.66324	.36172	1230.4	1.543	.92046	6.71364	.34613
9	0	1.630	.200	.4000	1208.0	1.511	.90444	6.59675	.38153	1211.3	1.515	.90638	6.61091	.37738	1222.4	1.531	.91449	6.67004	.35965
10	0	1.800	.225	.4500	1196.8	1.495	.89606	6.53567	.39907	1200.1	1.499	.89801	6.54986	.39505	1211.2	1.515	.90612	6.60901	.37794
11	0	2.030	.250	.5000	1184.0	1.476	.88649	6.46587	.41846	1188.9	1.482	.88964	6.48881	.41216	1201.6	1.501	.89895	6.55670	.39310
12	0	2.230	.275	.5500	1172.9	1.460	.87812	6.40478	.43493	1177.7	1.466	.88127	6.42776	.42879	1190.4	1.484	.89058	6.49566	.41027
13	0	2.400	.300	.6000	1156.9	1.436	.86616	6.31753	.45776	1163.3	1.445	.87051	6.34927	.44954	1177.6	1.465	.88102	6.42591	.42928
14	0	2.630	.325	.6500	1142.5	1.415	.85539	6.23899	.47770	1147.4	1.421	.85855	6.26205	.47190	1163.3	1.444	.87026	6.34744	.45002
15	0	2.900	.350	.7000	1123.3	1.387	.84103	6.13428	.50353	1129.8	1.395	.84540	6.16611	.49576	1145.7	1.418	.85711	6.25153	.47455
16	0	3.000	.375	.7500	1100.9	1.354	.82428	6.01212	.53275	1107.4	1.362	.82866	6.04401	.52520	1126.5	1.390	.84276	6.14690	.50046
17	0	3.200	.400	.8000	1077.0	1.318	.80634	5.88123	.56316	1085.0	1.329	.81192	5.92191	.55380	1102.5	1.355	.82483	6.01612	.53181
18	0	3.400	.425	.8500	1048.2	1.276	.78480	5.72417	.59870	1053.1	1.282	.78800	5.74748	.59348	1072.2	1.310	.80212	5.85046	.57020
19	0	3.600	.450	.9000	1003.5	1.210	.75131	5.47984	.65241	1009.9	1.218	.75572	5.51200	.64543	1029.0	1.246	.76984	5.61504	.62289
20	0	3.300	.475	.9500	936.4	1.111	.70106	5.11336	.73076	941.2	1.117	.70430	5.13697	.72576	957.1	1.140	.71605	5.22269	.70757
21	180	.230	.025	.0500	1283.1	1.622	.96067	7.00687	.24011	1280.0	1.617	.95780	6.98594	.24896	1279.9	1.616	.95752	6.98393	.24979
22	180	.430	.050	.1000	1287.9	1.629	.96426	7.03305	.22862	1286.4	1.626	.96258	7.02082	.23405	1283.1	1.621	.95991	7.00137	.24746
23	180	.630	.075	.1500	1294.3	1.639	.96904	7.06795	.21243	1291.2	1.633	.96617	7.04699	.22228	1286.3	1.625	.96230	7.01880	.23494
24	180	.800	.100	.2000	1299.1	1.646	.97263	7.09413	.19950	1296.0	1.640	.96976	7.07315	.20992	1287.9	1.628	.96350	7.02752	.23109
25	180	1.000	.125	.2500	1303.9	1.653	.97622	7.12031	.18574	1302.4	1.649	.97454	7.10804	.19230	1292.7	1.635	.96709	7.05368	.21918
26	180	1.230	.150	.3000	1310.3	1.662	.98101	7.15521	.16574	1307.2	1.657	.97813	7.13420	.17803	1295.9	1.640	.96948	7.07112	.21091
27	180	1.400	.175	.3500	1316.7	1.672	.98579	7.19011	.14313	1312.0	1.664	.98171	7.16037	.16259	1299.1	1.644	.97187	7.08856	.20232
28	180	1.600	.200	.4000	1321.5	1.679	.98938	7.21629	.12359	1316.8	1.671	.98530	7.18653	.14560	1300.7	1.647	.97306	7.09727	.19789
29	180	1.830	.225	.4500	1326.2	1.686	.99297	7.24247	.10045	1319.9	1.675	.98769	7.20397	.13313	1302.3	1.649	.97426	7.10599	.19338
30	180	2.000	.250	.5000	1331.0	1.693	.99656	7.26865	.07020	1323.1	1.680	.99008	7.22142	.11941	1303.9	1.651	.97545	7.11471	.18876
31	180	2.200	.275	.5500	1334.2	1.698	.99895	7.28610	.03873	1326.3	1.685	.99247	7.23886	.10394	1303.9	1.651	.97545	7.11471	.18876
32	180	2.400	.300	.6000	1337.4	1.702	1.00134	7.30355	.00000	1327.9	1.687	.99367	7.24758	.09528	1303.9	1.651	.97545	7.11471	.18876
33	180	2.600	.325	.6500	1340.6	1.707	1.00374	7.32100	.00000	1329.5	1.690	.99487	7.25630	.08578	1302.3	1.649	.97426	7.10599	.19338
34	180	2.800	.350	.7000	1340.6	1.707	1.00374	7.32100	.00000	1329.5	1.690	.99487	7.25630	.08578	1297.5	1.642	.97067	7.07984	.20665
35	180	3.000	.375	.7500	1340.6	1.707	1.00374	7.32100	.00000	1327.9	1.687	.99367	7.24758	.09528	1292.7	1.635	.96709	7.05368	.21918
36	180	3.200	.400	.8000	1335.8	1.700	1.00015	7.29482	.00000	1323.1	1.680	.99008	7.22142	.11941	1284.7	1.623	.96111	7.01008	.23873
37	180	3.400	.425	.8500	1326.2	1.686	.99297	7.24247	.10045	1310.4	1.661	.98052	7.15165	.16789	1267.1	1.597	.94796	6.91418	.27737
38	180	3.600	.450	.9000	1305.5	1.655	.97742	7.12903	.18094	1286.4	1.626	.96258	7.02082	.23405	1235.8	1.552	.92525	6.74851	.33501
39	180	3.800	.475	.9500	1255.9	1.582	.94033	6.85853	.29777	1233.7	1.548	.92312	6.73301	.33999	1176.0	1.463	.87982	6.41719	.43162
40	270	1.000	.125	.2500	1270.3	1.603	.95110	6.93706	.26859	1283.2	1.621	.96019	7.00338	.24161	1294.3	1.637	.96828	7.06240	.21508
41	270	2.000	.250	.5000	1252.7	1.577	.93794	6.84108	.30393	1280.0	1.617	.95780	6.98594	.24896	1303.9	1.651	.97545	7.11471	.18876
42	270	3.000	.375	.7500	1203.2	1.504	.90085	6.57058	.38912	1249.6	1.572	.93508	6.82023	.31116	1294.3	1.637	.96828	7.06240	.21508
43	90	1.000	.125	.2500	1267.1	1.599	.94870	6.91961	.27531	1252.8	1.576	.93747	6.83767	.30512	1244.8	1.564	.93122	6.79211	.32068
44	90	2.000	.250	.5000	1249.6	1.573	.93554	6.82363	.30999	1220.9	1.529	.91356	6.66324	.36172	1231.6	1.501	.89895	6.55670	.39310
45	90	3.000	.375	.7500	1198.4	1.497	.89726	6.54440	.39660	1157.0	1.435	.86572	6.31438	.45857	1124.9	1.388	.84157	6.13818	.50258

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE IX.- DATA[a] FOR 180° CONE; M_∞ = 2.30 - Concluded

(e) α = 20° - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 2290.8 psf					Φ = 90.0°, p_t = 2291.8 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1273.3	1.607	.95287	6.95003	.26351	1269.9	1.601	.94994	6.92860	.27187
2	0	.200	.025	.0500	1270.1	1.602	.95048	6.93259	.27033	1269.9	1.601	.94994	6.92860	.27187
3	0	.400	.050	.1000	1268.5	1.600	.94929	6.92387	.27368	1269.9	1.601	.94994	6.92860	.27187
4	0	.600	.075	.1500	1265.3	1.595	.94690	6.90643	.28029	1269.9	1.601	.94994	6.92860	.27187
5	0	.800	.100	.2000	1262.1	1.590	.94451	6.88899	.28676	1268.3	1.599	.94874	6.91989	.27520
6	0	1.000	.125	.2500	1257.3	1.583	.94092	6.86283	.29624	1265.1	1.594	.94635	6.90246	.28177
7	0	1.200	.150	.3000	1250.9	1.574	.93614	6.82795	.30850	1261.9	1.589	.94396	6.88503	.28821
8	0	1.400	.175	.3500	1244.5	1.564	.93135	6.79307	.32036	1258.7	1.585	.94157	6.86759	.29453
9	0	1.600	.200	.4000	1239.7	1.557	.92777	6.76690	.32903	1253.9	1.577	.93799	6.84145	.30380
10	0	1.800	.225	.4500	1231.7	1.546	.92179	6.72330	.34308	1249.1	1.570	.93440	6.81530	.31284
11	0	2.000	.250	.5000	1223.7	1.534	.91581	6.67970	.35669	1242.7	1.561	.92962	6.78044	.32457
12	0	2.200	.275	.5500	1215.7	1.522	.90983	6.63610	.36990	1234.7	1.549	.92365	6.73687	.33876
13	0	2.400	.300	.6000	1203.0	1.503	.90027	6.56634	.39034	1226.8	1.537	.91767	6.69329	.35249
14	0	2.600	.325	.6500	1191.8	1.487	.89190	6.50530	.40759	1215.6	1.521	.90931	6.63228	.37104
15	0	2.800	.350	.7000	1179.0	1.468	.88234	6.43554	.42670	1198.0	1.495	.89617	6.53642	.39886
16	0	3.000	.375	.7500	1158.2	1.437	.86679	6.32217	.45656	1178.8	1.467	.88183	6.43183	.42769
17	0	3.200	.400	.8000	1135.9	1.404	.85006	6.20009	.48739	1153.3	1.429	.86271	6.29239	.46620
18	0	3.400	.425	.8500	1107.1	1.362	.82853	6.04312	.52541	1113.3	1.370	.83284	6.07451	.51794
19	0	3.600	.450	.9000	1064.0	1.298	.79625	5.80768	.57992	1041.5	1.264	.77907	5.68232	.60801
20	0	3.800	.475	.9500	990.5	1.190	.74126	5.40655	.66825	1271.5	1.603	.95113	6.93732	.26850
21	180	.200	.025	.0500	1278.0	1.614	.95646	6.97619	.25298	1271.5	1.603	.95113	6.93732	.26850
22	180	.400	.050	.1000	1279.6	1.616	.95766	6.98491	.24938	1269.9	1.601	.94994	6.92860	.27187
23	180	.600	.075	.1500	1281.2	1.619	.95885	6.99363	.24574	1268.3	1.599	.94874	6.91989	.27520
24	180	.800	.100	.2000	1281.2	1.619	.95885	6.99363	.24574	1266.7	1.596	.94755	6.91117	.27850
25	180	1.000	.125	.2500	1281.2	1.619	.95885	6.99363	.24574	1263.5	1.592	.94516	6.89374	.28501
26	180	1.200	.150	.3000	1281.2	1.619	.95885	6.99363	.24574	1261.9	1.589	.94396	6.88503	.28821
27	180	1.400	.175	.3500	1281.2	1.619	.95885	6.99363	.24574	1258.7	1.585	.94157	6.86759	.29453
28	180	1.600	.200	.4000	1281.2	1.619	.95885	6.99363	.24574	1253.9	1.577	.93799	6.84145	.30380
29	180	1.800	.225	.4500	1279.6	1.616	.95766	6.98491	.24938	1249.1	1.570	.93440	6.81530	.31284
30	180	2.000	.250	.5000	1278.0	1.614	.95646	6.97619	.25298	1242.7	1.561	.92962	6.78044	.32457
31	180	2.200	.275	.5500	1274.9	1.609	.95407	6.95875	.26004	1236.3	1.552	.92684	6.74558	.33596
32	180	2.400	.300	.6000	1270.1	1.602	.95048	6.91259	.27033	1225.2	1.535	.91648	6.68458	.35519
33	180	2.600	.325	.6500	1265.3	1.595	.94690	6.90643	.28029	1214.0	1.519	.90812	6.62357	.37364
34	180	2.800	.350	.7000	1257.3	1.583	.94092	6.86283	.29624	1198.0	1.495	.89617	6.53642	.39886
35	180	3.000	.375	.7500	1246.1	1.567	.93255	6.80179	.31743	1178.8	1.467	.88183	6.43183	.42769
36	180	3.200	.400	.8000	1231.7	1.546	.92179	6.72330	.34308	1151.7	1.427	.86152	6.28367	.46642
37	180	3.400	.425	.8500	1207.8	1.510	.90386	6.59250	.38277	1110.1	1.366	.83045	6.05708	.52210
38	180	3.600	.450	.9000	1171.0	1.456	.87636	6.39193	.43834	1039.9	1.262	.77787	5.67361	.60995
39	180	3.800	.475	.9500	1103.9	1.357	.82614	6.02568	.52955	1303.4	1.650	.97503	7.11162	.19041
40	270	1.000	.125	.2500	1302.0	1.649	.97440	7.10699	.19285	1327.4	1.686	.99295	7.24235	.10056
41	270	2.000	.250	.5000	1322.8	1.680	.98994	7.22036	.12028	1337.0	1.700	1.00012	7.29464	.00000
42	270	3.000	.375	.7500	1327.6	1.687	.99352	7.24652	.09638	1234.7	1.549	.92365	6.73687	.33876
43	90	1.000	.125	.2500	1233.1	1.555	.92657	6.75818	.33188	1182.0	1.472	.88422	6.44926	.42298
44	90	2.000	.250	.5000	1187.0	1.480	.88831	6.47914	.41483	1100.6	1.352	.82328	6.00479	.53447
45	90	3.000	.375	.7500	1107.1	1.362	.82853	6.04312	.52541					

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE X.- DATA[a] FOR 180° CONE; $M_\infty = 2.96$

(a) $\alpha = 0°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 3244.0 psf					Φ = 22.5°, p_t = 3242.5 psf					Φ = 45.0°, p_t = 3240.9 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.300	.000	.0000	1091.1	1.734	.98979	11.63356	.12117	1090.5	1.734	.98976	11.63320	.12135	1088.9	1.732	.98880	11.62187	.12697
2	0	.230	.025	.0500	1091.1	1.734	.98979	11.63356	.12117	1090.5	1.734	.98976	11.63320	.12135	1090.5	1.735	.99025	11.63894	.11841
3	0	.430	.050	.1000	1091.1	1.734	.98979	11.63356	.12117	1090.5	1.734	.98976	11.63320	.12135	1090.5	1.735	.99025	11.63894	.11841
4	0	.530	.075	.1500	1089.5	1.731	.98834	11.61653	.12955	1088.9	1.731	.98831	11.61614	.12973	1090.5	1.735	.99025	11.63894	.11841
5	0	.800	.100	.2000	1087.9	1.728	.98689	11.59949	.13743	1087.3	1.728	.98686	11.59908	.13761	1088.9	1.732	.98880	11.62187	.12697
6	0	1.000	.125	.2500	1086.3	1.725	.98544	11.58246	.14489	1085.7	1.725	.98541	11.58202	.14508	1087.3	1.729	.98734	11.60481	.13501
7	0	1.200	.150	.3000	1084.7	1.723	.98399	11.56543	.15200	1084.1	1.723	.98395	11.56497	.15219	1084.1	1.724	.98444	11.57068	.14985
8	0	1.400	.175	.3500	1081.5	1.717	.98109	11.53136	.16535	1082.5	1.720	.98250	11.54791	.15900	1082.5	1.721	.98299	11.55361	.15676
9	0	1.600	.200	.4000	1078.3	1.712	.97820	11.49730	.17774	1079.3	1.714	.97960	11.51380	.17185	1079.3	1.715	.98008	11.51948	.16977
10	0	1.800	.225	.4500	1075.1	1.706	.97530	11.46323	.18937	1074.5	1.706	.97525	11.46262	.18957	1074.5	1.707	.97573	11.46828	.18768
11	0	2.000	.250	.5000	1068.7	1.695	.96950	11.39510	.21082	1069.7	1.698	.97089	11.41145	.20586	1069.7	1.698	.97137	11.41708	.20412
12	0	2.200	.275	.5500	1063.9	1.687	.96515	11.34400	.22567	1063.3	1.686	.96509	11.34322	.22589	1363.3	1.687	.96556	11.34882	.22430
13	0	2.400	.300	.6000	1055.9	1.673	.95791	11.25883	.24862	1056.9	1.675	.95928	11.27499	.24442	1356.9	1.676	.95976	11.28056	.24295
14	0	2.600	.325	.6500	1049.5	1.662	.95211	11.19070	.26570	1050.5	1.664	.95348	11.20676	.26177	1050.5	1.665	.95395	11.21229	.26040
15	0	2.800	.350	.7000	1038.3	1.642	.94197	11.07147	.29350	1039.3	1.645	.94332	11.08736	.28993	1039.3	1.646	.94378	11.09283	.28869
16	0	3.000	.375	.7500	1025.6	1.620	.93037	10.93521	.32275	1025.0	1.620	.93026	10.93384	.32303	1023.4	1.618	.92926	10.92217	.32544
17	0	3.200	.400	.8000	1008.0	1.589	.91443	10.74784	.35977	1007.4	1.589	.91429	10.74621	.36008	1007.4	1.590	.91474	10.75151	.35907
18	0	3.400	.425	.8500	984.0	1.548	.89269	10.49235	.40598	985.0	1.550	.89398	10.50740	.40336	983.4	1.548	.89297	10.49553	.40542
19	0	3.600	.450	.9000	948.9	1.487	.86081	10.11762	.46772	949.8	1.489	.86205	10.13214	.46543	948.2	1.487	.86102	10.12008	.46733
20	0	3.800	.475	.9500	886.6	1.378	.80429	9.45333	.56658	887.4	1.381	.80545	9.46690	.56465	884.2	1.376	.80294	9.43744	.56883
21	180	.200	.025	.0500	1095.8	1.742	.99414	11.68466	.09169	1095.7	1.743	.99446	11.68844	.08913	1094.1	1.741	.99350	11.67716	.09657
22	180	.400	.050	.1000	1095.8	1.742	.99414	11.68466	.09169	1094.1	1.740	.99301	11.67140	.10016	1092.5	1.738	.99205	11.66012	.10685
23	180	.630	.075	.1500	1094.3	1.739	.99269	11.66763	.10244	1092.5	1.737	.99156	11.65436	.11011	1092.5	1.738	.99205	11.66012	.10685
24	180	.800	.100	.2000	1092.7	1.737	.99124	11.65059	.11219	1089.3	1.732	.98866	11.62029	.12774	1089.3	1.733	.98915	11.62602	.12494
25	180	1.000	.125	.2500	1091.1	1.734	.98979	11.63356	.12117	1087.7	1.729	.98721	11.60325	.13573	1087.7	1.730	.98770	11.60898	.13309
26	180	1.200	.150	.3000	1089.5	1.731	.98834	11.61653	.12955	1086.1	1.726	.98576	11.58621	.14328	1086.1	1.727	.98625	11.59193	.14079
27	180	1.400	.175	.3500	1087.9	1.728	.98689	11.59949	.13743	1084.5	1.723	.98431	11.56917	.15047	1082.9	1.721	.98335	11.55783	.15507
28	180	1.600	.200	.4000	1086.3	1.725	.98544	11.58246	.14489	1081.3	1.718	.98141	11.53509	.16394	1079.7	1.716	.98045	11.52374	.16820
29	180	1.800	.225	.4500	1079.9	1.714	.97965	11.51433	.17165	1078.1	1.712	.97851	11.50102	.17643	1074.9	1.708	.97610	11.47260	.18624
30	180	2.000	.250	.5000	1076.7	1.709	.97675	11.48026	.18364	1071.7	1.701	.97271	11.43286	.19919	1070.1	1.699	.97174	11.42146	.20277
31	180	2.200	.275	.5500	1071.9	1.700	.97240	11.42916	.20036	1066.9	1.693	.96837	11.38175	.21479	1063.8	1.688	.96594	11.35327	.22304
32	180	2.400	.300	.6000	1063.9	1.687	.96515	11.34400	.22567	1060.6	1.682	.96257	11.31359	.23410	1057.4	1.677	.96014	11.28508	.24176
33	180	2.600	.325	.6500	1057.5	1.675	.95936	11.27587	.24419	1054.2	1.671	.95677	11.24544	.25206	1049.4	1.663	.95289	11.19985	.26347
34	180	2.800	.350	.7000	1046.3	1.656	.94921	11.15664	.27389	1043.0	1.651	.94662	11.12617	.28104	1039.8	1.646	.94419	11.09757	.28761
35	180	3.000	.375	.7500	1032.0	1.631	.93617	11.00334	.30841	1030.2	1.629	.93502	10.98986	.31129	1027.0	1.624	.93258	10.96119	.31735
36	180	3.200	.400	.8000	1015.0	1.603	.92168	10.83301	.34334	1012.6	1.598	.91908	10.80244	.34931	1011.0	1.596	.91808	10.79072	.35157
37	180	3.400	.425	.8500	992.0	1.562	.89994	10.57751	.39102	987.1	1.554	.89588	10.52982	.39945	985.5	1.552	.89487	10.51797	.40152
38	180	3.600	.450	.9000	955.9	1.501	.86806	10.20279	.45418	951.9	1.493	.86399	10.15497	.46181	950.3	1.491	.86297	10.14294	.46372
39	180	3.800	.475	.9500	894.6	1.392	.81154	9.53850	.55443	891.3	1.387	.80890	9.50751	.55887	888.1	1.382	.80640	9.47811	.56306
40	270	1.000	.125	.2500	1091.1	1.734	.98979	11.63356	.12117	1089.3	1.732	.98866	11.62029	.12774	1089.3	1.733	.98915	11.62602	.12494
41	270	2.000	.250	.5000	1071.9	1.700	.97240	11.42916	.20036	1071.7	1.701	.97271	11.43286	.19919	1071.7	1.702	.97319	11.43851	.19740
42	270	3.000	.375	.7500	1027.2	1.623	.93182	10.95224	.31922	1027.0	1.623	.93212	10.95578	.31848	1028.6	1.627	.93403	10.97824	.31376
43	90	1.000	.125	.2500	1084.7	1.723	.98399	11.56543	.15200	1082.5	1.720	.98250	11.54791	.15900	1084.1	1.724	.98444	11.57068	.14985
44	90	2.000	.250	.5000	1057.1	1.692	.96805	11.37806	.21587	1065.5	1.692	.96799	11.37734	.21609	1066.5	1.693	.96847	11.38295	.21443
45	90	3.000	.375	.7500	1025.6	1.620	.93037	10.93521	.32275	1023.4	1.617	.92881	10.91678	.32654	1023.4	1.618	.92926	10.92217	.32544

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE X.- DATA[a] FOR 180° CONE; $M_\infty = 2.96$ - Continued

(a) $\alpha = 0°$ - Concluded

Orifice	e, deg	s, in.	s/D	s/s*	$\Phi = 67.5°$, $p_t = 3241.3$ psf					$\Phi = 90.0°$, $p_t = 3238.1$ psf				
					p_t, psf	C_p	$p_t/p_{t,2}$	p_t/p_∞	M_t	p_t, psf	C_p	$p_t/p_{t,2}$	p_t/p_∞	M_t
1	0	.000	.000	.0000	1088.9	1.732	.98867	11.62044	.12767	1089.3	1.734	.99000	11.63608	.11989
2	0	.230	.025	.0500	1090.5	1.734	.99013	11.63750	.11915	1089.3	1.734	.99000	11.63608	.11989
3	0	.430	.050	.1000	1088.9	1.732	.98867	11.62044	.12767	1089.3	1.734	.99000	11.63608	.11989
4	0	.630	.075	.1500	1090.5	1.734	.99013	11.63750	.11915	1090.9	1.737	.99146	11.65314	.11079
5	0	.800	.100	.2000	1088.9	1.732	.98867	11.62044	.12767	1089.3	1.734	.99000	11.63608	.11989
6	0	1.300	.125	.2500	1087.3	1.729	.98722	11.60338	.13567	1087.7	1.731	.98855	11.61901	.12836
7	0	1.230	.150	.3000	1085.7	1.726	.98577	11.58631	.14324	1084.5	1.726	.98565	11.58489	.14385
8	0	1.400	.175	.3500	1082.5	1.721	.98287	11.55219	.15732	1081.3	1.720	.98275	11.55077	.15788
9	0	1.600	.200	.4000	1079.3	1.715	.97996	11.51806	.17029	1078.1	1.715	.97984	11.51664	.17081
10	0	1.800	.225	.4500	1076.1	1.709	.97706	11.48393	.18239	1074.9	1.709	.97694	11.48252	.18287
11	0	2.000	.250	.5000	1069.7	1.698	.97125	11.41567	.20456	1068.5	1.698	.97113	11.41427	.20499
12	0	2.230	.275	.5500	1064.9	1.690	.96690	11.36448	.21982	1063.8	1.690	.96678	11.36309	.22023
13	0	2.430	.300	.6000	1058.5	1.679	.96109	11.29623	.23879	1055.8	1.676	.95952	11.27778	.24368
14	0	2.630	.325	.6500	1052.1	1.668	.95528	11.22797	.25648	1047.8	1.662	.95226	11.19247	.26527
15	0	2.830	.350	.7000	1040.9	1.648	.94512	11.10853	.28511	1036.6	1.642	.94210	11.07304	.29315
16	0	3.000	.375	.7500	1025.0	1.620	.93060	10.93789	.32220	1020.8	1.620	.93049	10.93655	.32248
17	0	3.200	.400	.8000	1007.4	1.590	.91463	10.75019	.35933	1006.3	1.590	.91452	10.74887	.35958
18	0	3.430	.425	.8500	983.4	1.548	.89286	10.49423	.40565	982.3	1.548	.89275	10.49294	.40587
19	0	3.600	.450	.9000	948.2	1.487	.86092	10.11883	.46753	947.2	1.487	.86081	10.11758	.46773
20	0	3.800	.475	.9500	885.8	1.378	.80430	9.45334	.56658	884.9	1.378	.80420	9.45218	.56674
21	180	.230	.025	.0500	1095.7	1.743	.99483	11.69277	.08611	1094.1	1.743	.99436	11.68726	.08993
22	180	.400	.050	.1000	1092.5	1.738	.99193	11.65868	.10767	1092.5	1.740	.99291	11.67020	.10089
23	180	.600	.075	.1500	1090.9	1.735	.99048	11.64163	.11700	1089.3	1.734	.99000	11.63608	.11989
24	180	.800	.100	.2000	1087.7	1.730	.98758	11.60754	.13376	1087.7	1.731	.98855	11.61901	.12836
25	180	1.300	.125	.2500	1086.1	1.727	.98613	11.59050	.14142	1086.1	1.729	.98710	11.60195	.13632
26	180	1.200	.150	.3000	1082.9	1.721	.98323	11.55641	.15564	1082.9	1.723	.98420	11.56783	.15102
27	180	1.400	.175	.3500	1079.7	1.716	.98033	11.52232	.16872	1079.7	1.718	.98129	11.53371	.16446
28	180	1.600	.200	.4000	1078.1	1.713	.97888	11.50527	.17491	1076.5	1.712	.97839	11.49958	.17694
29	180	1.800	.225	.4500	1073.3	1.705	.97452	11.45414	.19236	1073.3	1.706	.97549	11.46546	.18863
30	180	2.000	.250	.5000	1070.1	1.699	.97162	11.42005	.20321	1068.5	1.698	.97113	11.41427	.20499
31	180	2.200	.275	.5500	1063.8	1.688	.96582	11.35187	.22344	1062.2	1.687	.96533	11.34603	.22510
32	180	2.400	.300	.6000	1057.4	1.677	.96002	11.28369	.24212	1055.8	1.676	.95952	11.27778	.24368
33	180	2.600	.325	.6500	1049.4	1.663	.95277	11.19847	.26381	1047.8	1.662	.95226	11.19247	.26527
34	180	2.800	.350	.7000	1039.8	1.646	.94407	11.09620	.28792	1036.6	1.642	.94210	11.07304	.29315
35	180	3.000	.375	.7500	1025.4	1.621	.93102	10.94279	.32118	1023.8	1.620	.93049	10.93655	.32248
36	180	3.200	.400	.8000	1007.8	1.591	.91507	10.75530	.35835	1007.8	1.592	.91597	10.76593	.35633
37	180	3.430	.425	.8500	983.9	1.549	.89331	10.49963	.40471	982.3	1.548	.89275	10.49294	.40587
38	180	3.600	.450	.9000	947.2	1.485	.85996	10.10760	.46930	947.2	1.487	.86081	10.11758	.46773
39	180	3.800	.475	.9500	886.5	1.379	.80485	9.45989	.56565	886.5	1.381	.80565	9.46924	.56432
40	270	1.000	.125	.2500	1090.9	1.735	.99048	11.64163	.11700	1089.3	1.734	.99000	11.63608	.11989
41	270	2.000	.250	.5000	1074.9	1.707	.97597	11.47118	.18671	1073.3	1.706	.97549	11.46546	.18863
42	270	3.000	.375	.7500	1031.8	1.632	.93682	11.01097	.30677	1031.8	1.634	.93775	11.02185	.30442
43	90	1.000	.125	.2500	1085.7	1.726	.98577	11.58631	.14324	1086.1	1.729	.98710	11.60195	.13632
44	90	2.000	.250	.5000	1068.1	1.695	.96980	11.39861	.20976	1068.5	1.698	.97113	11.41427	.20499
45	90	3.000	.375	.7500	1021.8	1.615	.92770	10.90376	.32920	1023.8	1.620	.93049	10.93655	.32248

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE X.- DATA[a] FOR 180° CONE; $M_\infty = 2.96$ - Continued

(b) $\alpha = 5°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 3244.2 psf					Φ = 22.5°, p_t = 3242.8 psf					Φ = 45.0°, p_t = 3244.1 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1084.3	1.722	.98359	11.56070	.15392	1084.5	1.723	.98422	11.56810	.15091	1084.5	1.722	.98383	11.56346	.15280
2	0	.200	.025	.0500	1082.7	1.719	.98214	11.54367	.16065	1082.9	1.720	.98277	11.55106	.15776	1082.9	1.720	.98238	11.54643	.15958
3	0	.400	.050	.1000	1082.7	1.719	.98214	11.54367	.16065	1081.3	1.718	.98132	11.53603	.16434	1082.9	1.720	.98238	11.54643	.15958
4	0	.600	.075	.1500	1079.5	1.714	.97924	11.50962	.17336	1079.7	1.715	.97987	11.51699	.17068	1081.3	1.717	.98093	11.52940	.16609
5	0	.800	.100	.2000	1077.9	1.711	.97780	11.49259	.17939	1078.1	1.712	.97842	11.49995	.17680	1079.7	1.714	.97948	11.51237	.17236
6	0	1.000	.125	.2500	1074.7	1.705	.97490	11.45854	.19091	1074.9	1.706	.97552	11.46588	.18849	1076.5	1.708	.97658	11.47831	.18430
7	0	1.200	.150	.3000	1069.9	1.697	.97055	11.40746	.20708	1071.7	1.701	.97262	11.43180	.19953	1073.3	1.703	.97368	11.44425	.19556
8	0	1.400	.175	.3500	1066.7	1.691	.96766	11.37341	.21723	1068.5	1.695	.96973	11.39773	.21003	1070.1	1.697	.97079	11.41019	.20624
9	0	1.600	.200	.4000	1061.9	1.683	.96331	11.32233	.23170	1063.8	1.687	.96538	11.34662	.22493	1065.3	1.689	.96644	11.35910	.22137
10	0	1.800	.225	.4500	1057.1	1.675	.95896	11.27125	.24539	1057.4	1.676	.95958	11.27847	.24350	1060.6	1.681	.96209	11.30801	.23561
11	0	2.000	.250	.5000	1050.8	1.664	.95317	11.20315	.26266	1052.6	1.668	.95523	11.22736	.25664	1054.2	1.670	.95630	11.23989	.25347
12	0	2.200	.275	.5500	1042.8	1.650	.94593	11.11802	.28293	1044.6	1.654	.94798	11.14218	.27731	1049.4	1.661	.95195	11.18880	.26617
13	0	2.400	.300	.6000	1034.8	1.636	.93868	11.03289	.30202	1036.6	1.640	.94074	11.05699	.29672	1039.8	1.645	.94326	11.08662	.29009
14	0	2.630	.325	.6500	1023.6	1.616	.92854	10.91371	.32717	1027.0	1.623	.93204	10.95477	.31869	1030.2	1.628	.93456	10.98644	.31245
15	0	2.800	.350	.7000	1010.8	1.594	.91696	10.77750	.35412	1014.2	1.601	.92044	10.81847	.34619	1019.0	1.609	.92442	10.86523	.33696
16	0	3.000	.375	.7500	994.9	1.566	.90247	10.60724	.38571	999.9	1.576	.90740	10.66514	.37519	1004.7	1.584	.91138	10.71196	.36652
17	0	3.200	.400	.8000	977.3	1.536	.88654	10.41995	.41838	979.1	1.540	.88855	10.44366	.41435	983.9	1.547	.89254	10.49057	.40628
18	0	3.400	.425	.8500	950.2	1.489	.86191	10.13051	.46569	955.1	1.498	.86681	10.18811	.45653	958.3	1.503	.86936	10.21808	.45172
19	0	3.630	.450	.9000	915.0	1.428	.83004	9.75593	.52280	918.4	1.434	.83347	9.79626	.51683	923.2	1.442	.83748	9.84342	.50980
20	0	3.800	.475	.9500	851.1	1.317	.77210	9.07489	.61926	856.1	1.326	.77694	9.13181	.61146	860.9	1.334	.78098	9.17924	.60492
21	180	.230	.025	.0500	1392.3	1.736	.99083	11.64583	.11477	1090.9	1.734	.99002	11.63625	.11980	1089.3	1.731	.98817	11.61455	.13048
22	180	.400	.050	.1000	1092.3	1.736	.99083	11.64583	.11477	1090.9	1.734	.99002	11.63625	.11980	1090.9	1.733	.98962	11.63158	.12217
23	180	.600	.075	.1500	1092.3	1.736	.99083	11.64583	.11477	1089.3	1.731	.98857	11.61921	.12826	1089.3	1.731	.98817	11.61455	.13048
24	180	.800	.100	.2000	1092.3	1.736	.99083	11.64583	.11477	1090.9	1.734	.99002	11.63625	.11980	1087.7	1.728	.98672	11.59752	.13831
25	180	1.000	.125	.2500	1092.3	1.736	.99083	11.64583	.11477	1090.9	1.734	.99002	11.63625	.11980	1087.7	1.728	.98672	11.59752	.13831
26	180	1.200	.150	.3000	1092.3	1.736	.99083	11.64583	.11477	1089.3	1.731	.98857	11.61921	.12826	1086.1	1.725	.98528	11.58049	.14573
27	180	1.400	.175	.3500	1090.7	1.733	.98939	11.62880	.12357	1087.7	1.729	.98712	11.60217	.13621	1084.5	1.722	.98383	11.56346	.15280
28	180	1.600	.200	.4000	1090.7	1.733	.98939	11.62880	.12357	1087.7	1.729	.98712	11.60217	.13621	1082.9	1.720	.98238	11.54643	.15958
29	180	1.800	.225	.4500	1089.1	1.730	.98794	11.61178	.13179	1086.1	1.726	.98567	11.58514	.14374	1079.7	1.714	.97948	11.51237	.17236
30	180	2.000	.250	.5000	1087.5	1.727	.98649	11.59475	.13954	1081.3	1.718	.98132	11.53403	.16434	1078.1	1.711	.97803	11.49534	.17843
31	180	2.200	.275	.5500	1082.7	1.719	.98214	11.54367	.16065	1078.1	1.712	.97842	11.49995	.17680	1073.3	1.703	.97368	11.44425	.19556
32	180	2.430	.300	.6000	1079.5	1.714	.97924	11.50962	.17336	1074.9	1.706	.97552	11.46588	.18849	1068.5	1.695	.96934	11.39316	.21140
33	180	2.600	.325	.6500	1073.1	1.702	.97345	11.44151	.19644	1068.5	1.695	.96973	11.39773	.21003	1062.2	1.683	.96354	11.32504	.23095
34	180	2.800	.350	.7000	1063.5	1.686	.96476	11.33936	.22697	1060.6	1.681	.96248	11.31255	.23438	1052.6	1.667	.95485	11.22286	.25777
35	180	3.000	.375	.7500	1053.9	1.669	.95607	11.23720	.25415	1049.4	1.662	.95233	11.19329	.26507	1041.4	1.647	.94470	11.10365	.28623
36	180	3.200	.400	.8000	1039.6	1.644	.94303	11.08397	.29069	1035.0	1.637	.93929	11.03995	.30047	1027.0	1.622	.93166	10.95038	.31960
37	180	3.400	.425	.8500	1018.8	1.608	.92420	10.86263	.33748	1012.6	1.598	.91899	10.80144	.34950	1003.1	1.581	.90993	10.69493	.36969
38	180	3.600	.450	.9000	986.9	1.553	.89523	10.52211	.40080	979.1	1.540	.88855	10.44366	.41435	967.9	1.520	.87805	10.32026	.43506
39	180	3.800	.475	.9500	927.8	1.450	.84163	9.89214	.50247	920.0	1.437	.83492	9.81329	.51430	910.4	1.420	.82589	9.70718	.52998
40	270	1.000	.125	.2500	1085.9	1.725	.98504	11.57772	.14690	1087.7	1.729	.98712	11.60217	.13621	1089.3	1.731	.98817	11.61455	.13048
41	270	2.000	.250	.5000	1069.9	1.697	.97055	11.40746	.20708	1076.9	1.706	.97552	11.46588	.18849	1079.7	1.714	.97948	11.51237	.17236
42	270	3.000	.375	.7500	1023.6	1.616	.92854	10.91371	.32717	1035.0	1.637	.93929	11.03995	.30047	1046.2	1.656	.94905	11.15474	.27434
43	90	1.000	.125	.2500	1079.5	1.714	.97924	11.50962	.17336	1078.1	1.712	.97842	11.49995	.17680	1074.9	1.706	.97513	11.46128	.19001
44	90	2.000	.250	.5000	1065.1	1.689	.96621	11.35638	.22215	1057.4	1.676	.95958	11.27847	.24350	1052.6	1.667	.95485	11.22286	.25777
45	90	3.000	.375	.7500	1022.0	1.614	.92710	10.89668	.33063	1012.6	1.598	.91899	10.80144	.34950	1003.1	1.581	.90993	10.69493	.36969

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE X.- DATA[a] FOR 180° CONE; $M_\infty = 2.96$ - Continued

(b) $\alpha = 5°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 3240.9 psf					Φ = 90.0°, p_t = 3243.0 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.030	.000	.0000	1084.1	1.724	.98444	11.57068	.14985	1084.5	1.723	.98416	11.56739	.15120
2	0	.200	.025	.0500	1084.1	1.724	.98444	11.57068	.14985	1082.9	1.723	.98271	11.55035	.15804
3	0	.400	.050	.1000	1084.1	1.724	.98444	11.57068	.14985	1084.5	1.723	.98416	11.56739	.15120
4	0	.630	.075	.1500	1082.5	1.721	.98299	11.55361	.15676	1084.5	1.723	.98416	11.56739	.15120
5	0	.830	.100	.2000	1082.5	1.721	.98299	11.55361	.15676	1084.5	1.723	.98416	11.56739	.15120
6	0	1.030	.125	.2500	1079.3	1.715	.98308	11.51948	.16977	1082.9	1.720	.98271	11.55035	.15804
7	0	1.230	.150	.3000	1076.1	1.710	.97718	11.48535	.18190	1079.7	1.715	.97981	11.51628	.17094
8	0	1.400	.175	.3500	1074.5	1.707	.97573	11.46828	.18768	1078.1	1.712	.97836	11.49924	.17705
9	0	1.630	.200	.4000	1069.7	1.698	.97137	11.41708	.20412	1076.5	1.709	.97691	11.48221	.18298
10	0	1.830	.225	.4500	1064.9	1.690	.96702	11.36589	.21942	1070.1	1.698	.97111	11.41406	.20506
11	0	2.000	.250	.5000	1060.1	1.682	.96266	11.31469	.23380	1065.3	1.690	.96677	11.36296	.22027
12	0	2.200	.275	.5500	1053.7	1.671	.95685	11.24642	.25181	1059.0	1.679	.96097	11.29481	.23917
13	0	2.400	.300	.6000	1044.1	1.654	.94814	11.14403	.27687	1052.6	1.667	.95517	11.22667	.25681
14	0	2.630	.325	.6500	1036.2	1.640	.94088	11.05870	.29634	1044.6	1.654	.94792	11.14149	.27747
15	0	2.830	.350	.7000	1025.0	1.621	.93072	10.93924	.32192	1035.0	1.637	.93923	11.03927	.30062
16	0	3.000	.375	.7500	1010.6	1.596	.91765	10.78565	.35255	1020.6	1.612	.92618	10.88595	.33280
17	0	3.200	.400	.8000	993.0	1.565	.90168	10.59792	.38738	1003.1	1.581	.91024	10.69855	.36902
18	0	3.400	.425	.8500	967.4	1.520	.87845	10.32487	.43430	979.1	1.540	.88850	10.44302	.41446
19	0	3.630	.450	.9000	932.2	1.459	.84650	9.94942	.49378	944.0	1.479	.85661	10.06823	.47546
20	0	3.800	.475	.9500	868.3	1.348	.78842	9.26678	.59279	883.3	1.373	.80153	9.42086	.57118
21	180	.200	.025	.0500	1087.7	1.730	.98770	11.60898	.13309	1089.3	1.731	.98851	11.61849	.12861
22	180	.400	.050	.1000	1087.7	1.730	.98770	11.60898	.13309	1087.7	1.729	.98706	11.60146	.13654
23	180	.600	.075	.1500	1087.7	1.730	.98770	11.60898	.13309	1086.1	1.726	.98561	11.58442	.14405
24	180	.800	.100	.2000	1086.1	1.727	.98625	11.59193	.14079	1084.5	1.723	.98416	11.56739	.15120
25	180	1.000	.125	.2500	1086.1	1.727	.98625	11.59193	.14079	1081.3	1.717	.98126	11.53331	.16461
26	180	1.200	.150	.3000	1082.9	1.721	.98335	11.55783	.15507	1079.7	1.715	.97981	11.51628	.17094
27	180	1.400	.175	.3500	1079.7	1.716	.98045	11.52374	.16820	1076.5	1.709	.97691	11.48221	.18298
28	180	1.600	.200	.4000	1078.1	1.713	.97900	11.50669	.17441	1073.3	1.704	.97401	11.44814	.19431
29	180	1.800	.225	.4500	1076.9	1.708	.97610	11.47260	.18624	1070.1	1.698	.97111	11.41406	.20506
30	180	2.000	.250	.5000	1071.7	1.702	.97319	11.43851	.19760	1063.8	1.687	.96532	11.34592	.22513
31	180	2.230	.275	.5500	1065.9	1.694	.96884	11.38737	.21313	1059.0	1.679	.96097	11.29481	.23917
32	180	2.400	.300	.6000	1060.6	1.683	.96304	11.31918	.23257	1052.6	1.667	.95517	11.22667	.25681
33	180	2.630	.325	.6500	1054.2	1.671	.95724	11.25099	.25064	1044.6	1.654	.94792	11.14149	.27747
34	180	2.800	.350	.7000	1044.6	1.655	.94854	11.14871	.27577	1035.0	1.637	.93923	11.03927	.30062
35	180	3.000	.375	.7500	1031.8	1.633	.93694	11.01233	.30648	1022.2	1.615	.92763	10.90299	.32935
36	180	3.230	.400	.8000	1015.8	1.605	.92243	10.84186	.34159	1004.7	1.584	.91169	10.71559	.36584
37	180	3.400	.425	.8500	991.9	1.563	.90068	10.58616	.38948	980.7	1.542	.88995	10.46005	.41154
38	180	3.600	.450	.9000	956.7	1.502	.86877	10.21113	.45284	944.0	1.479	.85661	10.06823	.47546
39	180	3.800	.475	.9500	896.0	1.396	.81365	9.56334	.55086	884.9	1.376	.80298	9.43790	.56877
40	270	1.000	.125	.2500	1090.9	1.735	.99060	11.64307	.11624	1090.9	1.734	.98996	11.63553	.12017
41	270	2.000	.250	.5000	1082.9	1.721	.98335	11.55783	.15507	1082.9	1.720	.98271	11.55035	.15804
42	270	3.000	.375	.7500	1052.6	1.669	.95579	11.23394	.25498	1055.8	1.673	.95807	11.26074	.24813
43	90	1.000	.125	.2500	1072.9	1.704	.97428	11.45122	.19331	1073.3	1.704	.97401	11.44814	.19431
44	90	2.000	.250	.5000	1050.5	1.665	.95395	11.21229	.26040	1051.0	1.665	.95372	11.20963	.26106
45	90	3.000	.375	.7500	996.2	1.570	.90458	10.63205	.38123	995.1	1.567	.90299	10.61338	.38460

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE X.- DATA[a] FOR 180° CONE; $M_\infty = 2.96$ - Continued

(c) $\alpha = 10°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 3243.9 psf					Φ = 22.5°, p_t = 3241.1 psf					Φ = 45.0°, p_t = 3238.0 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1076.2	1.708	.97637	11.47583	.18515	1076.1	1.710	.97712	11.48464	.18214	1074.9	1.709	.97697	11.48288	.18275
2	0	.200	.025	.0500	1073.0	1.703	.97347	11.44178	.19636	1072.9	1.704	.97422	11.45051	.19354	1073.3	1.706	.97552	11.46581	.18851
3	0	.400	.050	.1000	1068.2	1.694	.96913	11.39070	.21213	1068.1	1.696	.96986	11.39931	.20955	1070.1	1.701	.97261	11.43169	.19956
4	0	.600	.075	.1500	1065.1	1.689	.96623	11.35665	.22208	1064.9	1.690	.96696	11.36518	.21962	1068.5	1.698	.97116	11.41463	.20488
5	0	.800	.100	.2000	1061.9	1.683	.96333	11.32259	.23163	1061.7	1.684	.96405	11.33106	.22929	1063.8	1.690	.96681	11.36344	.22013
6	0	1.000	.125	.2500	1057.1	1.675	.95899	11.27151	.24533	1055.3	1.673	.95825	11.26280	.24760	1060.6	1.684	.96390	11.32932	.22977
7	0	1.200	.150	.3000	1050.7	1.664	.95319	11.20341	.26259	1052.1	1.668	.95534	11.22867	.25631	1055.8	1.676	.95955	11.27813	.24350
8	0	1.400	.175	.3500	1044.3	1.653	.94740	11.13530	.27891	1045.7	1.657	.94953	11.16041	.27300	1051.0	1.667	.95519	11.22694	.25674
9	0	1.600	.200	.4000	1039.5	1.644	.94305	11.08422	.29063	1039.3	1.646	.94373	11.09215	.28884	1044.6	1.656	.94939	11.15869	.27340
10	0	1.800	.225	.4500	1031.5	1.630	.93581	10.99909	.30932	1031.4	1.632	.93647	11.00682	.30767	1039.8	1.648	.94503	11.10751	.28534
11	0	2.000	.250	.5000	1023.5	1.616	.92857	10.91396	.32712	1025.0	1.620	.93066	10.93856	.32206	1031.8	1.634	.93777	11.02220	.30435
12	0	2.200	.275	.5500	1017.1	1.605	.92277	10.84585	.34081	1017.0	1.607	.92340	10.85324	.33934	1025.4	1.623	.93197	10.95395	.31886
13	0	2.400	.300	.6000	1006.0	1.586	.91263	10.72667	.36377	1007.4	1.590	.91469	10.75085	.35923	1015.8	1.606	.92326	10.85157	.33967
14	0	2.600	.325	.6500	994.8	1.566	.90249	10.60748	.38566	996.2	1.570	.90453	10.63140	.38135	1004.7	1.587	.91310	10.73214	.36274
15	0	2.800	.350	.7000	983.4	1.542	.88945	10.45424	.41256	981.8	1.545	.89146	10.47781	.40849	991.9	1.565	.90148	10.59564	.38779
16	0	3.000	.375	.7500	964.5	1.514	.87497	10.28398	.44102	967.4	1.520	.87839	10.32423	.43440	975.9	1.537	.88697	10.42502	.41752
17	0	3.200	.400	.8000	943.7	1.478	.85613	10.06263	.47633	946.6	1.484	.85952	10.10239	.47012	956.7	1.503	.86955	10.22027	.45137
18	0	3.400	.425	.8500	918.1	1.433	.83296	9.79021	.51773	919.4	1.437	.83483	9.81228	.51445	931.2	1.459	.84632	9.94728	.49411
19	0	3.600	.450	.9000	881.4	1.369	.79964	9.39860	.57432	882.6	1.373	.80144	9.41979	.57133	894.4	1.395	.81293	9.55484	.55209
20	0	3.800	.475	.9500	819.1	1.261	.74314	8.73457	.66528	821.9	1.267	.74627	8.77133	.66036	832.2	1.286	.75632	8.88942	.64447
21	180	.200	.025	.0500	1082.6	1.719	.98216	11.54394	.16055	1084.5	1.724	.98474	11.57417	.14840	1082.9	1.723	.98423	11.56819	.15087
22	180	.400	.050	.1000	1085.8	1.725	.98506	11.57799	.14679	1086.1	1.727	.98619	11.59121	.14110	1084.5	1.726	.98568	11.58525	.14369
23	180	.600	.075	.1500	1087.4	1.728	.98651	11.59502	.13943	1086.1	1.727	.98619	11.59121	.14110	1084.5	1.726	.98568	11.58525	.14369
24	180	.800	.100	.2000	1089.0	1.730	.98796	11.61204	.13166	1087.7	1.730	.98764	11.60826	.13343	1086.1	1.729	.98713	11.60231	.13615
25	180	1.000	.125	.2500	1090.6	1.733	.98941	11.62907	.12343	1089.3	1.732	.98909	11.62531	.12530	1088.1	1.729	.98713	11.60231	.13615
26	180	1.200	.150	.3000	1092.2	1.736	.99086	11.64610	.11463	1090.9	1.735	.99054	11.64235	.11662	1086.1	1.729	.98713	11.60231	.13615
27	180	1.400	.175	.3500	1092.2	1.736	.99086	11.64610	.11463	1090.9	1.735	.99054	11.64235	.11662	1087.7	1.731	.98858	11.61937	.12818
28	180	1.600	.200	.4000	1092.2	1.736	.99086	11.64610	.11463	1090.9	1.735	.99054	11.64235	.11662	1086.1	1.729	.98713	11.60231	.13615
29	180	1.800	.225	.4500	1092.2	1.736	.99086	11.64610	.11463	1090.9	1.735	.99054	11.64235	.11662	1086.1	1.729	.98713	11.60231	.13615
30	180	2.000	.250	.5000	1092.2	1.736	.99086	11.64610	.11463	1090.9	1.735	.99054	11.64235	.11662	1082.9	1.723	.98423	11.56819	.15087
31	180	2.200	.275	.5500	1090.6	1.733	.98941	11.62907	.12343	1087.7	1.730	.98764	11.60826	.13343	1079.7	1.718	.98132	11.53406	.16433
32	180	2.400	.300	.6000	1089.0	1.730	.98796	11.61204	.13166	1086.1	1.727	.98619	11.59121	.14110	1076.5	1.712	.97842	11.49994	.17681
33	180	2.600	.325	.6500	1084.2	1.722	.98361	11.56096	.15382	1081.3	1.719	.98184	11.54008	.16204	1070.1	1.701	.97261	11.43169	.19956
34	180	2.800	.350	.7000	1079.4	1.714	.97927	11.50988	.17326	1076.5	1.710	.97749	11.48894	.18066	1063.8	1.690	.96681	11.36344	.22013
35	180	3.000	.375	.7500	1071.4	1.700	.97202	11.42475	.20174	1068.5	1.696	.97023	11.40371	.20822	1054.2	1.673	.95810	11.26107	.24804
36	180	3.200	.400	.8000	1060.3	1.680	.96188	11.30557	.23627	1055.8	1.674	.95863	11.26734	.24641	1039.8	1.648	.94503	11.10751	.28534
37	180	3.400	.425	.8500	1042.7	1.650	.94595	11.11828	.28287	1038.2	1.644	.94268	11.07984	.29162	1019.0	1.612	.92616	10.88570	.33285
38	180	3.600	.450	.9000	1014.0	1.600	.91987	10.81180	.34749	1006.3	1.588	.91367	10.73892	.36146	987.1	1.556	.89713	10.54445	.39688
39	180	3.800	.475	.9500	958.1	1.503	.86917	10.21587	.45208	951.9	1.493	.86436	10.15936	.46112	929.6	1.456	.84487	9.93021	.49670
40	270	1.000	.125	.2500	1073.0	1.703	.97347	11.44178	.19636	1079.7	1.716	.98039	11.52303	.16846	1084.5	1.726	.98568	11.58525	.14369
41	270	2.000	.250	.5000	1058.7	1.678	.96044	11.28854	.24084	1070.1	1.699	.97168	11.42075	.20299	1082.9	1.723	.98423	11.56819	.15087
42	270	3.000	.375	.7500	1015.6	1.603	.92132	10.82883	.34416	1036.6	1.641	.94123	11.06279	.29543	1055.8	1.676	.95955	11.27813	.24359
43	90	1.000	.125	.2500	1073.0	1.703	.97347	11.44178	.19636	1066.5	1.693	.96841	11.38225	.21464	1062.2	1.687	.96536	11.34638	.22500
44	90	2.000	.250	.5000	1057.1	1.675	.95899	11.27151	.24533	1044.1	1.654	.94808	11.14334	.27703	1035.0	1.640	.94068	11.05632	.29687
45	90	3.000	.375	.7500	1014.0	1.600	.91987	10.81180	.34749	993.0	1.565	.90162	10.59727	.38750	977.5	1.540	.88842	10.44208	.41462

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE X.- DATA[a] FOR 180° CONE; $M_\infty = 2.96$ - Continued

(c) $\alpha = 10°$ - Concluded

Orifice	e, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 3240.7 psf					Φ = 90.0°, p_t = 3239.8 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1074.5	1.707	.97579	11.46899	.18745	1074.9	1.708	.97643	11.47650	.18492
2	0	.200	.025	.0500	1072.9	1.704	.97434	11.45192	.19308	1073.3	1.705	.97498	11.45944	.19062
3	0	.400	.050	.1000	1071.3	1.701	.97288	11.43486	.19856	1073.3	1.705	.97498	11.45944	.19062
4	0	.600	.075	.1500	1069.7	1.699	.97143	11.41779	.20391	1073.3	1.705	.97498	11.45944	.19062
5	0	.800	.100	.2000	1068.1	1.696	.96998	11.40072	.20912	1073.3	1.705	.97498	11.45944	.19062
6	0	1.000	.125	.2500	1063.3	1.687	.96562	11.34952	.22411	1071.7	1.703	.97353	11.44239	.19616
7	0	1.200	.150	.3000	1061.7	1.685	.95417	11.33245	.22890	1068.5	1.697	.97062	11.40828	.20683
8	0	1.400	.175	.3500	1058.5	1.679	.96127	11.29832	.23823	1066.9	1.694	.96917	11.39123	.21197
9	0	1.600	.200	.4000	1053.7	1.671	.95691	11.24712	.25163	1063.8	1.689	.96627	11.35713	.22194
10	0	1.800	.225	.4500	1048.9	1.662	.95256	11.19592	.26443	1063.6	1.683	.96337	11.32302	.23151
11	0	2.000	.250	.5000	1042.5	1.651	.94675	11.12765	.28070	1055.8	1.675	.95902	11.27186	.24524
12	0	2.200	.275	.5500	1036.2	1.640	.94094	11.05938	.29619	1051.0	1.666	.95466	11.22070	.25830
13	0	2.400	.300	.6000	1028.2	1.626	.93368	10.97405	.31464	1043.0	1.653	.94741	11.13544	.27888
14	0	2.600	.325	.6500	1018.6	1.610	.92497	10.87165	.33567	1035.0	1.639	.94016	11.05018	.29823
15	0	2.800	.350	.7000	1007.4	1.590	.91480	10.75218	.35895	1025.4	1.622	.93145	10.94786	.32013
16	0	3.000	.375	.7500	991.4	1.562	.90028	10.58151	.39031	1012.6	1.600	.91984	10.81144	.34756
17	0	3.200	.400	.8000	973.8	1.532	.88431	10.39377	.42281	995.1	1.569	.90388	10.62386	.38271
18	0	3.400	.425	.8500	948.2	1.487	.86107	10.12070	.46723	972.7	1.530	.88357	10.38512	.42426
19	0	3.600	.450	.9000	913.0	1.426	.82913	9.74523	.52438	937.6	1.469	.85165	10.00996	.48450
20	0	3.800	.475	.9500	850.7	1.317	.77250	9.07962	.61862	876.9	1.363	.79652	9.36196	.57948
21	180	.200	.025	.0500	1081.3	1.719	.98196	11.54150	.16149	1079.7	1.717	.98078	11.52765	.16674
22	180	.400	.050	.1000	1081.3	1.719	.98196	11.54150	.16149	1079.7	1.717	.98078	11.52765	.16674
23	180	.600	.075	.1500	1081.3	1.719	.98196	11.54150	.16149	1078.1	1.714	.97933	11.51060	.17300
24	180	.800	.100	.2000	1081.3	1.719	.98196	11.54150	.16149	1076.5	1.711	.97788	11.49355	.17905
25	180	1.000	.125	.2500	1079.7	1.716	.98051	11.52445	.16793	1076.5	1.711	.97788	11.49355	.17905
26	180	1.200	.150	.3000	1079.7	1.716	.98051	11.52445	.16793	1073.3	1.705	.97498	11.45944	.19062
27	180	1.400	.175	.3500	1079.7	1.716	.98051	11.52445	.16793	1070.1	1.700	.97207	11.42534	.20156
28	180	1.600	.200	.4000	1078.1	1.713	.97906	11.50740	.17415	1066.9	1.694	.96917	11.39123	.21197
29	180	1.800	.225	.4500	1074.9	1.708	.97616	11.47331	.18600	1063.8	1.689	.96627	11.35713	.22194
30	180	2.000	.250	.5000	1071.7	1.702	.97325	11.43921	.19718	1059.0	1.680	.96192	11.30597	.23617
31	180	2.200	.275	.5500	1069.5	1.697	.97035	11.40512	.20779	1054.2	1.672	.95757	11.25481	.24966
32	180	2.400	.300	.6000	1062.2	1.685	.96455	11.33692	.22765	1046.2	1.658	.95031	11.16955	.27081
33	180	2.600	.325	.6500	1055.8	1.674	.95875	11.26873	.24605	1038.2	1.644	.94306	11.08428	.29062
34	180	2.800	.350	.7000	1047.8	1.660	.95150	11.18349	.26746	1028.6	1.628	.93435	10.98197	.31297
35	180	3.000	.375	.7500	1035.0	1.638	.93989	11.04711	.29890	1014.2	1.603	.92129	10.82849	.34422
36	180	3.200	.400	.8000	1020.6	1.613	.92684	10.89368	.33124	998.3	1.575	.90679	10.65796	.37651
37	180	3.400	.425	.8500	998.3	1.574	.90653	10.65500	.37705	974.3	1.533	.88502	10.40217	.42139
38	180	3.500	.450	.9000	964.7	1.516	.87607	10.29700	.43889	939.2	1.472	.85310	10.02701	.48186
39	180	3.800	.475	.9500	905.6	1.413	.82241	9.66622	.53597	878.5	1.366	.79797	9.37901	.57708
40	270	1.000	.125	.2500	1087.7	1.730	.98776	11.60969	.13276	1089.3	1.733	.98948	11.62997	.12298
41	270	2.000	.250	.5000	1087.7	1.730	.98776	11.60969	.13276	1090.9	1.736	.99094	11.64702	.11413
42	270	3.000	.375	.7500	1065.9	1.694	.96890	11.38807	.21292	1071.7	1.703	.97353	11.44239	.19616
43	90	1.300	.125	.2500	1056.9	1.676	.95982	11.28125	.24277	1055.8	1.675	.95902	11.27186	.24524
44	90	2.300	.250	.5000	1026.6	1.623	.93223	10.95698	.31823	1023.8	1.619	.93000	10.93081	.32366
45	90	3.300	.375	.7500	969.0	1.523	.87995	10.34257	.43137	964.7	1.516	.87632	10.29986	.43842

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE X.- DATA[a] FOR 180° CONE; $M_\infty = 2.96$ - Continued

(d) $\alpha = 15°$

Orifice	θ, deg	s, in.	s/D	s/s*	$\Phi = 0.0°$, $p_t = 3245.1$ psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1059.0	1.677	.96041	11.28829	.24091
2	0	.200	.025	.0500	1054.2	1.669	.95607	11.23721	.25415
3	0	.400	.050	.1000	1051.0	1.664	.95317	11.20316	.26265
4	0	.600	.075	.1500	1046.3	1.655	.94883	11.15208	.27497
5	0	.800	.100	.2000	1039.9	1.644	.94303	11.08397	.29069
6	0	1.000	.125	.2500	1035.1	1.636	.93869	11.03290	.30202
7	0	1.200	.150	.3000	1028.7	1.625	.93289	10.96479	.31659
8	0	1.400	.175	.3500	1020.7	1.611	.92565	10.87966	.33407
9	0	1.600	.200	.4000	1014.3	1.600	.91985	10.81156	.34753
10	0	1.800	.225	.4500	1006.3	1.586	.91261	10.72643	.36381
11	0	2.000	.250	.5000	996.7	1.569	.90392	10.62427	.38264
12	0	2.200	.275	.5500	987.2	1.553	.89523	10.52211	.40080
13	0	2.400	.300	.6000	977.6	1.536	.88654	10.41996	.41838
14	0	2.600	.325	.6500	964.8	1.514	.87495	10.28375	.44106
15	0	2.800	.350	.7000	950.4	1.489	.86191	10.13051	.46569
16	0	3.000	.375	.7500	932.8	1.458	.84598	9.94323	.49472
17	0	3.200	.400	.8000	912.1	1.422	.82714	9.72189	.52782
18	0	3.400	.425	.8500	884.9	1.375	.80252	9.43244	.56954
19	0	3.600	.450	.9000	848.2	1.311	.76920	9.04085	.62392
20	0	3.800	.475	.9500	790.7	1.211	.71705	8.42791	.70602
21	180	.200	.025	.0500	1059.0	1.695	.96948	11.39482	.21090
22	180	.400	.050	.1000	1072.2	1.700	.97237	11.42884	.20046
23	180	.600	.075	.1500	1075.4	1.706	.97527	11.46285	.18949
24	180	.800	.100	.2000	1078.6	1.712	.97816	11.49687	.17789
25	180	1.000	.125	.2500	1081.8	1.717	.98105	11.53088	.16553
26	180	1.200	.150	.3000	1085.0	1.723	.98395	11.56489	.15222
27	180	1.400	.175	.3500	1086.6	1.725	.98539	11.58190	.14513
28	180	1.600	.200	.4000	1088.2	1.728	.98684	11.59891	.13769
29	180	1.800	.225	.4500	1091.4	1.734	.98974	11.63292	.12149
30	180	2.000	.250	.5000	1093.0	1.736	.99118	11.64993	.11255
31	180	2.200	.275	.5500	1093.0	1.736	.99118	11.64993	.11255
32	180	2.400	.300	.6000	1094.6	1.739	.99263	11.66694	.10286
33	180	2.600	.325	.6500	1093.0	1.736	.99118	11.64993	.11255
34	180	2.800	.350	.7000	1091.4	1.734	.98974	11.63292	.12149
35	180	3.000	.375	.7500	1088.2	1.728	.98684	11.59891	.13769
36	180	3.200	.400	.8000	1080.2	1.714	.97961	11.51387	.17182
37	180	3.400	.425	.8500	1067.4	1.692	.96803	11.37782	.21594
38	180	3.600	.450	.9000	1043.5	1.650	.94633	11.12271	.28184
39	180	3.800	.475	.9500	995.6	1.567	.90292	10.61249	.38476
40	270	1.000	.125	.2500	1059.5	1.678	.96080	11.29278	.23971
41	270	2.000	.250	.5000	1043.5	1.650	.94633	11.12271	.28184
42	270	3.000	.375	.7500	1002.0	1.578	.90870	10.68052	.37236
43	90	1.000	.125	.2500	1057.4	1.675	.95897	11.27126	.24539
44	90	2.000	.250	.5000	1043.1	1.650	.94593	11.11803	.28293
45	90	3.000	.375	.7500	1001.5	1.578	.90826	10.67535	.37331

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE X.- DATA[a] FOR 180° CONE; M_∞ = 2.96 - Continued

(e) α = 20°

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 3245.2 psf					Φ = 22.5°, p_t = 3241.4 psf					Φ = 45.0°, p_t = 3240.3 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	1036.4	1.638	.93984	11.04651	.29903	1036.5	1.640	.94101	11.06023	.29600	1034.6	1.638	.93960	11.04368	.29966
2	0	.200	.025	.0500	1030.0	1.627	.93405	10.97843	.31372	1031.7	1.632	.93666	11.00910	.30718	1029.8	1.629	.93525	10.99247	.31074
3	0	.400	.050	.1000	1025.2	1.619	.92971	10.92736	.32437	1026.9	1.624	.93231	10.95798	.31802	1026.6	1.624	.93234	10.95833	.31794
4	0	.600	.075	.1500	1018.8	1.608	.92391	10.85928	.33814	1020.5	1.613	.92651	10.88981	.33202	1023.4	1.618	.92944	10.92420	.32502
5	0	.800	.100	.2000	1012.4	1.596	.91812	10.79120	.35148	1015.7	1.604	.92216	10.83868	.34222	1018.6	1.610	.92508	10.87299	.33541
6	0	1.000	.125	.2500	1006.0	1.585	.91233	10.72311	.36443	1007.7	1.590	.91491	10.75347	.35870	1013.8	1.601	.92072	10.82178	.34554
7	0	1.200	.150	.3000	999.7	1.574	.90654	10.65503	.37704	1001.3	1.579	.90911	10.68531	.37148	1007.4	1.590	.91491	10.75350	.35870
8	0	1.400	.175	.3500	991.7	1.560	.89930	10.56993	.39237	993.3	1.565	.90186	10.60010	.38699	1001.0	1.579	.90911	10.68523	.37149
9	0	1.600	.200	.4000	983.7	1.546	.89205	10.48482	.40728	985.9	1.554	.89606	10.53193	.39908	995.2	1.571	.90475	10.63402	.38087
10	0	1.800	.225	.4500	972.5	1.527	.88192	10.36568	.42752	977.4	1.538	.88736	10.42968	.41673	988.2	1.557	.89749	10.54868	.39613
11	0	2.000	.250	.5000	962.9	1.510	.87323	10.26355	.44436	967.8	1.521	.87866	10.32743	.43388	978.6	1.540	.88877	10.44626	.41390
12	0	2.200	.275	.5500	953.3	1.494	.86454	10.16143	.46079	958.2	1.504	.86996	10.22517	.45058	970.6	1.526	.88151	10.36092	.42831
13	0	2.400	.300	.6000	942.2	1.474	.85440	10.04228	.47950	947.0	1.485	.85981	10.10588	.46957	959.4	1.507	.87135	10.24143	.44795
14	0	2.600	.325	.6500	927.8	1.449	.84137	9.88909	.50293	934.2	1.462	.84821	9.96954	.49071	948.2	1.487	.86118	10.12195	.46704
15	0	2.800	.350	.7000	915.0	1.427	.82978	9.75293	.52325	919.9	1.437	.83517	9.81617	.51387	935.4	1.465	.84956	9.98540	.48828
16	0	3.000	.375	.7500	897.5	1.397	.81386	9.56570	.55052	903.9	1.410	.82067	9.64575	.53895	917.8	1.434	.83359	9.79764	.51663
17	0	3.200	.400	.8000	876.7	1.361	.79503	9.34443	.58194	883.1	1.374	.80182	9.42420	.57071	898.6	1.401	.81616	9.59281	.54662
18	0	3.400	.425	.8500	849.5	1.313	.77041	9.05507	.62197	857.6	1.329	.77862	9.15153	.60874	871.5	1.354	.79147	9.30264	.58779
19	0	3.600	.450	.9000	813.0	1.255	.74000	8.69764	.67022	822.5	1.268	.74672	8.77661	.65965	837.9	1.295	.76098	8.94418	.63706
20	0	3.800	.475	.9500	761.7	1.161	.69076	8.11893	.74663	766.6	1.171	.69597	8.18014	.73861	778.7	1.192	.70724	8.31263	.72121
21	180	.200	.025	.0500	1047.6	1.658	.94998	11.16566	.27175	1047.6	1.660	.95116	11.17952	.26842	1046.2	1.658	.95016	11.16782	.27123
22	180	.400	.050	.1000	1352.4	1.666	.95432	11.21672	.25930	1350.8	1.665	.95406	11.21361	.26007	1047.8	1.661	.95162	11.18487	.26712
23	180	.600	.075	.1500	1057.1	1.674	.95867	11.26778	.24630	1055.6	1.674	.95841	11.26473	.24709	1051.0	1.666	.95452	11.21897	.25874
24	180	.800	.100	.2000	1061.9	1.682	.96301	11.31884	.23266	1060.4	1.682	.96276	11.31586	.23348	1054.2	1.672	.95742	11.25307	.25011
25	180	1.000	.125	.2500	1066.7	1.691	.96736	11.36991	.21825	1063.6	1.688	.96566	11.34994	.22399	1055.8	1.675	.95887	11.27012	.24569
26	180	1.200	.150	.3000	1071.5	1.699	.97170	11.42097	.20292	1066.8	1.693	.96856	11.38403	.21411	1059.0	1.680	.96177	11.30422	.23664
27	180	1.400	.175	.3500	1074.7	1.705	.97460	11.45501	.19207	1071.6	1.701	.97291	11.43515	.19847	1060.6	1.683	.96322	11.32127	.23199
28	180	1.600	.200	.4000	1079.5	1.713	.97894	11.50607	.17463	1076.4	1.710	.97726	11.48628	.18158	1063.8	1.688	.96612	11.35537	.22244
29	180	1.800	.225	.4500	1084.3	1.721	.98329	11.55713	.15535	1079.6	1.715	.98316	11.52036	.16944	1066.9	1.694	.96902	11.38947	.21250
30	180	2.000	.250	.5000	1087.5	1.727	.98618	11.59118	.14112	1082.8	1.721	.98306	11.55445	.15642	1068.5	1.697	.97047	11.40652	.20736
31	180	2.200	.275	.5500	1092.3	1.735	.99053	11.64224	.11668	1086.0	1.726	.98596	11.58853	.14227	1068.5	1.697	.97047	11.40652	.20736
32	180	2.400	.300	.6000	1095.5	1.741	.99342	11.67628	.09713	1089.2	1.732	.98886	11.62261	.12661	1070.1	1.700	.97192	11.42357	.20211
33	180	2.600	.325	.6500	1097.1	1.744	.99487	11.69330	.08573	1093.8	1.735	.99031	11.63966	.11803	1068.5	1.697	.97047	11.40652	.20736
34	180	2.800	.350	.7000	1098.7	1.746	.99632	11.71032	.07258	1092.4	1.738	.99176	11.65670	.10880	1066.9	1.694	.96902	11.38947	.21250
35	180	3.000	.375	.7500	1098.7	1.746	.99632	11.71032	.07258	1090.8	1.735	.99031	11.63966	.11803	1063.8	1.688	.96612	11.35537	.22244
36	180	3.200	.400	.8000	1097.1	1.744	.99487	11.69330	.08573	1087.6	1.729	.98741	11.60557	.13466	1055.8	1.675	.95887	11.27012	.24569
37	180	3.400	.425	.8500	1090.7	1.732	.98908	11.62522	.12534	1079.6	1.715	.98016	11.52036	.16944	1043.0	1.652	.94726	11.13372	.27928
38	180	3.600	.450	.9000	1373.1	1.702	.97315	11.43799	.19757	1060.4	1.682	.96276	11.31586	.23348	1019.0	1.611	.92550	10.87797	.33441
39	180	3.800	.475	.9500	1033.2	1.633	.93995	11.01247	.30645	1018.9	1.610	.92506	10.87277	.33545	971.1	1.527	.88198	10.36647	.42738
40	270	1.300	.125	.2500	1036.4	1.638	.93984	11.04651	.29903	1047.6	1.660	.95116	11.17952	.26842	1055.8	1.675	.95887	11.27012	.24569
41	270	2.000	.250	.5000	1022.0	1.613	.92681	10.89332	.33131	1046.0	1.657	.94971	11.16248	.27250	1056.9	1.694	.96902	11.38947	.21250
42	270	3.000	.375	.7500	980.5	1.541	.88916	10.45078	.41313	1022.1	1.615	.92796	10.90685	.32857	1362.2	1.686	.96467	11.33832	.22726
43	90	1.300	.125	.2500	1034.8	1.635	.93840	11.02949	.30276	1023.7	1.618	.92941	10.92389	.32508	1013.8	1.601	.92072	10.82178	.34554
44	90	2.000	.250	.5000	1018.8	1.608	.92391	10.85928	.33814	996.5	1.571	.90476	10.63418	.38084	978.6	1.540	.88877	10.44626	.41390
45	90	3.300	.375	.7500	980.5	1.541	.88916	10.45078	.41313	947.0	1.485	.85981	10.10588	.46957	917.8	1.434	.83359	9.79764	.51663

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE X.- DATA[a] FOR 180° CONE; M_∞ = 2.96 - Concluded

(e) α = 20° - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 3239.6 psf					Φ = 90.0°, p_t = 3238.7 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.030	.000	.0000	1034.6	1.638	.93981	11.04607	.29913	1034.9	1.639	.94041	11.05316	.29757
2	0	.230	.025	.0500	1033.0	1.635	.93835	11.02899	.30287	1034.9	1.639	.94041	11.05316	.29757
3	0	.430	.050	.1000	1031.4	1.632	.93690	11.01192	.30657	1034.9	1.639	.94041	11.05316	.29757
4	0	.630	.075	.1500	1028.2	1.627	.93400	10.97777	.31386	1034.9	1.639	.94041	11.05316	.29757
5	0	.830	.100	.2000	1026.6	1.624	.93254	10.96070	.31745	1034.9	1.639	.94041	11.05316	.29757
6	0	1.030	.125	.2500	1021.8	1.616	.92819	10.90948	.32803	1033.3	1.636	.93896	11.03610	.30132
7	0	1.230	.150	.3000	1018.6	1.610	.92528	10.87534	.33493	1032.1	1.631	.93606	11.00199	.30870
8	0	1.430	.175	.3500	1013.8	1.602	.92092	10.82412	.34508	1028.5	1.628	.93460	10.98493	.31234
9	0	1.630	.200	.4000	1009.0	1.593	.91656	10.77290	.35500	1026.9	1.625	.93315	10.96788	.31594
10	0	1.830	.225	.4500	1002.6	1.582	.91075	10.70461	.36789	1022.2	1.617	.92880	10.91670	.32656
11	0	2.030	.250	.5000	996.2	1.571	.90494	10.63632	.38045	1019.0	1.611	.92590	10.88259	.33348
12	0	2.230	.275	.5500	989.8	1.560	.89913	10.56803	.39271	1014.2	1.603	.92154	10.83142	.34365
13	0	2.430	.300	.6000	978.6	1.541	.88897	10.44852	.41352	1006.2	1.589	.91429	10.74613	.36010
14	0	2.630	.325	.6500	969.0	1.524	.88025	10.34608	.43078	998.2	1.575	.90703	10.66084	.37598
15	0	2.830	.350	.7000	957.8	1.504	.87008	10.22657	.45035	990.2	1.561	.89977	10.57556	.39137
16	0	3.030	.375	.7500	941.8	1.477	.85556	10.05585	.47739	975.8	1.536	.88671	10.42204	.41803
17	0	3.230	.400	.8000	924.2	1.446	.83958	9.86805	.50610	959.9	1.508	.87220	10.25147	.44632
18	0	3.430	.425	.8500	900.2	1.404	.81779	9.61195	.54385	939.1	1.472	.85333	10.02972	.48144
19	0	3.630	.450	.9000	865.1	1.343	.78583	9.23635	.59702	907.2	1.417	.82431	9.68857	.53270
20	0	3.830	.475	.9500	804.3	1.237	.73064	8.59759	.68488	846.5	1.311	.76916	9.04039	.62398
21	180	.230	.025	.0500	1044.6	1.655	.94892	11.15318	.27471	1039.7	1.648	.94476	11.10433	.28607
22	180	.430	.050	.1000	1044.6	1.655	.94892	11.15318	.27471	1039.7	1.648	.94476	11.10433	.28607
23	180	.630	.075	.1500	1046.2	1.658	.95037	11.17024	.27065	1038.1	1.645	.94331	11.08728	.28994
24	180	.830	.100	.2000	1046.2	1.658	.95037	11.17024	.27065	1036.5	1.642	.94186	11.07022	.29378
25	180	1.030	.125	.2500	1046.2	1.658	.95037	11.17024	.27065	1034.9	1.639	.94041	11.05316	.29757
26	180	1.230	.150	.3000	1047.8	1.661	.95182	11.18729	.26653	1033.3	1.636	.93896	11.03610	.30132
27	180	1.430	.175	.3500	1047.8	1.661	.95182	11.18729	.26653	1031.7	1.634	.93751	11.01905	.30503
28	180	1.630	.200	.4000	1047.8	1.661	.95182	11.18729	.26653	1028.5	1.628	.93460	10.98493	.31234
29	180	1.830	.225	.4500	1047.8	1.661	.95182	11.18729	.26653	1025.3	1.622	.93170	10.95082	.31951
30	180	2.030	.250	.5000	1046.2	1.658	.95037	11.17024	.27065	1022.2	1.617	.92880	10.91670	.32656
31	180	2.230	.275	.5500	1044.6	1.655	.94892	11.15318	.27471	1017.4	1.609	.92445	10.86553	.33690
32	180	2.430	.300	.6000	1041.4	1.650	.94602	11.11907	.28268	1011.0	1.597	.91864	10.79730	.35030
33	180	2.630	.325	.6500	1038.2	1.644	.94312	11.08497	.29047	1003.0	1.584	.91138	10.71201	.36651
34	180	2.830	.350	.7000	1031.8	1.633	.93731	11.01675	.30553	993.4	1.567	.90268	10.60967	.38527
35	180	3.030	.375	.7500	1023.8	1.619	.93036	10.93148	.32352	982.2	1.547	.89252	10.49027	.40634
36	180	3.230	.400	.8000	1012.6	1.600	.91990	10.81211	.34743	967.9	1.522	.87946	10.33675	.43233
37	180	3.430	.425	.8500	993.5	1.566	.90249	10.60746	.38567	943.9	1.481	.85769	10.08089	.47348
38	180	3.630	.450	.9000	964.7	1.516	.87637	10.30049	.43832	910.4	1.422	.82721	9.72269	.52770
39	180	3.830	.475	.9500	910.4	1.422	.82704	9.72066	.52800	854.5	1.325	.77642	9.12568	.61230
40	270	1.030	.125	.2500	1062.2	1.686	.96488	11.34077	.22657	1063.7	1.689	.96653	11.36019	.22106
41	270	2.030	.250	.5000	1082.9	1.722	.98374	11.56247	.15321	1087.6	1.731	.98830	11.61605	.12977
42	270	3.030	.375	.7500	1090.9	1.736	.99100	11.64774	.11374	1098.8	1.750	.99846	11.73546	.04694
43	90	1.030	.125	.2500	1307.4	1.591	.91511	10.75583	.35825	1004.6	1.586	.91284	10.72907	.36331
44	90	2.030	.250	.5000	967.4	1.521	.87880	10.32901	.43361	963.1	1.514	.87510	10.28558	.44076
45	90	3.030	.375	.7500	901.8	1.407	.81924	9.62903	.54138	896.0	1.397	.81415	9.56917	.55002

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE XI.- DATA[a] FOR 180° CONE; $M_\infty = 3.95$

(a) $\alpha = 0°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 5765.1 psf					Φ = 22.5°, p_t = 5765.1 psf					Φ = 45.0°, p_t = 5765.1 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	818.6	1.755	.98058	20.16389	.16763	818.6	1.755	.98058	20.16389	.16763	818.6	1.755	.98058	20.16389	.16763
2	0	.200	.025	.0500	818.6	1.755	.98058	20.16389	.16763	818.6	1.755	.98058	20.16389	.16763	818.6	1.755	.98058	20.16389	.16763
3	0	.400	.050	.1000	818.6	1.755	.98058	20.16389	.16763	818.6	1.755	.98058	20.16389	.16763	818.6	1.755	.98058	20.16389	.16763
4	0	.600	.075	.1500	818.6	1.755	.98058	20.16389	.16763	818.6	1.755	.98058	20.16389	.16763	818.6	1.755	.98058	20.16389	.16763
5	0	.800	.100	.2000	818.6	1.755	.98058	20.16389	.16763	818.6	1.755	.98058	20.16389	.16763	818.6	1.755	.98058	20.16389	.16763
6	0	1.000	.125	.2500	818.6	1.755	.98058	20.16389	.16763	818.6	1.755	.98058	20.16389	.16763	818.6	1.755	.98058	20.16389	.16763
7	0	1.200	.150	.3000	817.0	1.751	.97866	20.12451	.17581	817.0	1.751	.97866	20.12451	.17581	817.0	1.751	.97866	20.12451	.17581
8	0	1.400	.175	.3500	815.4	1.747	.97675	20.08513	.18365	817.0	1.751	.97866	20.12451	.17581	815.4	1.747	.97675	20.08513	.18365
9	0	1.600	.200	.4000	813.8	1.744	.97483	20.04575	.19118	815.4	1.747	.97675	20.08513	.18365	813.8	1.744	.97483	20.04575	.19118
10	0	1.800	.225	.4500	812.2	1.740	.97291	20.00636	.19845	812.2	1.740	.97291	20.00636	.19845	813.6	1.737	.97100	19.96698	.20547
11	0	2.000	.250	.5000	809.0	1.733	.96908	19.92760	.21228	809.0	1.733	.96908	19.92760	.21228	807.4	1.729	.96717	19.88822	.21890
12	0	2.200	.275	.5500	805.8	1.726	.96525	19.84883	.22533	805.8	1.726	.96525	19.84883	.22533	804.2	1.722	.96334	19.80945	.23161
13	0	2.400	.300	.6000	802.6	1.719	.96142	19.77007	.23773	801.0	1.715	.95951	19.73068	.24372	799.4	1.711	.95759	19.69130	.24957
14	0	2.600	.325	.6500	797.8	1.708	.95568	19.65192	.25531	796.2	1.704	.95376	19.61254	.26094	793.0	1.697	.94993	19.53377	.27188
15	0	2.800	.350	.7000	791.4	1.693	.94802	19.49439	.27721	789.8	1.690	.94610	19.45501	.28245	785.0	1.679	.94036	19.33686	.29770
16	0	3.000	.375	.7500	780.2	1.668	.93461	19.21871	.31232	780.2	1.668	.93461	19.21871	.31232	775.4	1.657	.92887	19.10056	.32640
17	0	3.200	.400	.8000	769.0	1.643	.92120	18.94303	.34443	767.4	1.639	.91929	18.90365	.34882	762.6	1.628	.91354	18.78550	.36175
18	0	3.400	.425	.8500	751.4	1.603	.90014	18.50982	.39061	749.8	1.600	.89822	18.47044	.39461	745.0	1.589	.89268	18.35229	.40642
19	0	3.600	.450	.9000	724.2	1.542	.86758	17.84032	.45508	722.6	1.538	.86566	17.80094	.45868	717.9	1.527	.85992	17.68279	.46937
20	0	3.800	.475	.9500	674.7	1.430	.80821	16.61946	.56003	674.7	1.430	.80821	16.61946	.56003	669.9	1.419	.80246	16.50131	.56963
21	180	.200	.025	.0500	825.7	1.771	.98905	20.33821	.12550	824.1	1.767	.98714	20.29887	.13611	824.1	1.767	.98714	20.29887	.13611
22	180	.400	.050	.1000	824.1	1.767	.98714	20.29887	.13611	824.1	1.767	.98714	20.29887	.13611	824.1	1.767	.98714	20.29887	.13611
23	180	.600	.075	.1500	822.5	1.763	.98523	20.25953	.14597	822.5	1.763	.98523	20.25953	.14597	820.9	1.760	.98331	20.22019	.15523
24	180	.800	.100	.2000	820.9	1.760	.98331	20.22019	.15523	820.9	1.760	.98331	20.22019	.15523	820.9	1.760	.98331	20.22019	.15523
25	180	1.000	.125	.2500	820.9	1.760	.98331	20.22019	.15523	819.3	1.756	.98140	20.18085	.16399	817.7	1.753	.97949	20.14151	.17233
26	180	1.200	.150	.3000	819.3	1.756	.98140	20.18085	.16399	817.7	1.753	.97949	20.14151	.17233	816.1	1.749	.97757	20.10217	.18030
27	180	1.400	.175	.3500	816.1	1.749	.97757	20.10217	.18030	815.1	1.749	.97757	20.10217	.18030	814.5	1.745	.97566	20.06284	.18795
28	180	1.600	.200	.4000	814.5	1.745	.97566	20.06284	.18795	812.9	1.742	.97375	20.02350	.19532	811.3	1.738	.97184	19.98416	.20244
29	180	1.800	.225	.4500	812.9	1.742	.97375	20.02350	.19532	811.3	1.738	.97184	19.98416	.20244	808.1	1.731	.96801	19.90548	.21602
30	180	2.000	.250	.5000	809.7	1.735	.96992	19.94482	.20933	806.5	1.727	.96610	19.86614	.22253	804.9	1.724	.96418	19.82680	.22886
31	180	2.200	.275	.5500	804.9	1.724	.96418	19.82680	.22886	803.3	1.720	.96227	19.78746	.23505	800.1	1.713	.95844	19.70879	.24699
32	180	2.400	.300	.6000	800.1	1.713	.95844	19.70879	.24699	798.5	1.709	.95653	19.66945	.25277	796.9	1.706	.95462	19.63011	.25844
33	180	2.600	.325	.6500	793.7	1.699	.95079	19.55143	.26946	792.1	1.695	.94888	19.51209	.27482	790.5	1.691	.94697	19.47275	.28010
34	180	2.800	.350	.7000	785.7	1.681	.94123	19.35474	.29544	784.1	1.677	.93931	19.31540	.30040	782.5	1.673	.93740	19.27606	.30530
35	180	3.000	.375	.7500	776.1	1.659	.92975	19.11870	.32427	774.5	1.655	.92783	19.07936	.32887	772.9	1.652	.92592	19.04002	.33342
36	180	3.200	.400	.8000	763.4	1.630	.91444	18.80399	.35975	760.2	1.623	.91062	18.72531	.36819	760.2	1.623	.91062	18.72531	.36819
37	180	3.400	.425	.8500	744.2	1.587	.89149	18.33192	.40843	742.6	1.583	.88957	18.29259	.41230	741.0	1.580	.88766	18.25325	.41614
38	180	3.600	.450	.9000	717.1	1.526	.85896	17.66316	.47114	713.9	1.518	.85514	17.58449	.47816	713.9	1.518	.85514	17.58449	.47816
39	180	3.800	.475	.9500	669.1	1.418	.80157	16.48300	.57111	667.5	1.414	.79966	16.44366	.57429	667.5	1.414	.79966	16.44366	.57429
40	270	1.000	.125	.2500	820.9	1.760	.98331	20.22019	.15523	820.9	1.760	.98331	20.22019	.15523	819.3	1.756	.98140	20.18085	.16399
41	270	2.000	.250	.5000	806.5	1.727	.96610	19.86614	.22253	806.5	1.727	.96610	19.86614	.22253	808.1	1.731	.96801	19.90548	.21602
42	270	3.000	.375	.7500	772.9	1.652	.92592	19.04002	.33342	771.4	1.648	.92401	19.00069	.33792	774.5	1.655	.92783	19.07936	.32887
43	90	1.000	.125	.2500	815.4	1.747	.97675	20.08513	.18365	815.4	1.747	.97675	20.08513	.18365	815.4	1.747	.97675	20.08513	.18365
44	90	2.000	.250	.5000	802.6	1.719	.96142	19.77007	.23773	804.2	1.722	.96334	19.80945	.23161	805.8	1.726	.96525	19.84883	.22533
45	90	3.000	.375	.7500	772.2	1.650	.92504	19.02180	.33551	772.2	1.650	.92504	19.02180	.33551	775.4	1.657	.92887	19.10056	.32640

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE XI.- DATA[a] FOR 180° CONE; $M_\infty = 3.95$ - Continued

(a) $\alpha = 0°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	$\Phi = 67.5°$, $p_t = 5755.6$ psf					$\Phi = 90.0°$, $p_t = 5765.1$ psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	818.5	1.758	.98212	20.19574	.16073	818.5	1.755	.98051	20.16249	.16793
2	0	.025	.025	.0500	818.5	1.758	.98212	20.19574	.16073	816.9	1.751	.97859	20.12311	.17610
3	0	.050	.050	.1000	818.5	1.758	.98212	20.19574	.16073	818.5	1.755	.98051	20.16249	.16793
4	0	.075	.075	.1500	818.5	1.758	.98212	20.19574	.16073	818.5	1.755	.98051	20.16249	.16793
5	0	.100	.100	.2000	818.5	1.758	.98212	20.19574	.16073	816.9	1.751	.97859	20.12311	.17610
6	0	.125	.125	.2500	815.9	1.754	.98021	20.15629	.16924	815.9	1.751	.97859	20.12311	.17610
7	0	.150	.150	.3000	815.3	1.750	.97829	20.11685	.17736	815.3	1.747	.97668	20.08373	.18392
8	0	.175	.175	.3500	813.7	1.747	.97637	20.07740	.18515	812.1	1.740	.97285	20.00497	.19870
9	0	.200	.200	.4000	812.1	1.743	.97445	20.03796	.19264	808.9	1.733	.96902	19.92621	.21252
10	0	.225	.225	.4500	808.9	1.736	.97061	19.95907	.20686	805.7	1.726	.96519	19.84745	.22556
11	0	.250	.250	.5000	804.1	1.725	.96486	19.84073	.22664	802.5	1.718	.96136	19.76869	.23794
12	0	.275	.275	.5500	800.9	1.718	.96102	19.76184	.23899	799.3	1.711	.95753	19.68993	.24978
13	0	.300	.300	.6000	796.1	1.707	.95527	19.64351	.25652	792.9	1.697	.94987	19.53241	.27206
14	0	.325	.325	.6500	788.1	1.689	.94568	19.44629	.28360	786.5	1.682	.94221	19.37489	.29287
15	0	.350	.350	.7000	781.7	1.675	.93801	19.28851	.30376	778.6	1.664	.93263	19.17800	.31723
16	0	.375	.375	.7500	772.2	1.653	.92650	19.05184	.33206	767.4	1.639	.91923	18.90234	.34897
17	0	.400	.400	.8000	757.8	1.620	.90923	18.69683	.37121	754.6	1.610	.90391	18.58730	.38267
18	0	.425	.425	.8500	740.2	1.581	.88813	18.26294	.41519	737.0	1.571	.88284	18.15412	.42570
19	0	.450	.450	.9000	713.0	1.519	.85552	17.59238	.47745	708.2	1.506	.84837	17.44528	.49043
20	0	.475	.475	.9500	665.0	1.411	.79798	16.40904	.57708	661.8	1.401	.79283	16.30326	.58556
21	180	.200	.025	.0500	824.0	1.770	.98870	20.33093	.12753	824.0	1.767	.98707	20.29746	.13647
22	180	.400	.050	.1000	822.4	1.766	.98678	20.29152	.13800	824.0	1.767	.98707	20.29746	.13647
23	180	.600	.075	.1500	820.8	1.763	.98487	20.25212	.14776	820.8	1.760	.98325	20.21879	.15555
24	180	.800	.100	.2000	819.2	1.759	.98295	20.21272	.15693	819.2	1.756	.98133	20.17945	.16430
25	180	1.000	.125	.2500	817.6	1.756	.98103	20.17332	.16562	817.6	1.752	.97942	20.14011	.17262
26	180	1.200	.150	.3000	816.0	1.752	.97912	20.13392	.17389	816.0	1.749	.97751	20.10078	.18057
27	180	1.400	.175	.3500	814.4	1.748	.97720	20.09452	.18181	814.4	1.745	.97559	20.06144	.18821
28	180	1.600	.200	.4000	811.2	1.741	.97337	20.01572	.19674	811.2	1.738	.97177	19.98277	.20268
29	180	1.800	.225	.4500	808.0	1.734	.96954	19.93692	.21069	808.0	1.731	.96794	19.90410	.21625
30	180	2.000	.250	.5000	804.8	1.727	.96571	19.85811	.22383	806.4	1.727	.96603	19.86476	.22775
31	180	2.200	.275	.5500	800.0	1.716	.95996	19.73991	.24233	803.0	1.713	.95838	19.70742	.24719
32	180	2.400	.300	.6000	795.3	1.705	.95421	19.62171	.25964	796.8	1.706	.95455	19.62874	.25863
33	180	2.600	.325	.6500	788.9	1.691	.94654	19.46410	.28125	790.5	1.691	.94690	19.47140	.28028
34	180	2.800	.350	.7000	780.9	1.673	.93696	19.26710	.30641	782.5	1.673	.93733	19.27472	.30547
35	180	3.000	.375	.7500	771.3	1.651	.92547	19.03069	.33449	772.9	1.652	.92586	19.03870	.33357
36	180	3.200	.400	.8000	758.5	1.622	.91014	18.71548	.36924	763.1	1.623	.91055	18.72401	.36833
37	180	3.400	.425	.8500	741.0	1.582	.88906	18.28207	.41332	742.6	1.583	.88951	18.29131	.41242
38	180	3.600	.450	.9000	712.2	1.517	.85457	17.57285	.47919	715.4	1.522	.85699	17.62260	.47476
39	180	3.800	.475	.9500	665.9	1.413	.79901	16.43023	.57537	669.1	1.418	.80152	16.48185	.57120
40	270	1.000	.125	.2500	820.8	1.763	.98487	20.25212	.14776	819.2	1.756	.98133	20.17945	.16430
41	270	2.000	.250	.5000	809.6	1.737	.97145	19.97632	.20383	808.0	1.731	.96794	19.90410	.21625
42	270	3.000	.375	.7500	777.7	1.665	.93313	19.18830	.31600	776.1	1.659	.92968	19.11737	.32443
43	90	1.000	.125	.2500	816.9	1.754	.98021	20.15629	.16924	816.9	1.751	.97859	20.12311	.17610
44	90	2.000	.250	.5000	807.3	1.732	.96870	19.91962	.21364	808.9	1.733	.96902	19.92621	.21252
45	90	3.000	.375	.7500	777.0	1.664	.93225	19.17017	.31817	780.1	1.668	.93455	19.21738	.31249

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE XI.- DATA[a] FOR 180° CONE; $M_\infty = 3.95$ - Continued

(b) $\alpha = 5°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 5765.1 psf					Φ = 22.5°, p_t = 5765.1 psf					Φ = 45.0°, p_t = 5765.1 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	820.2	1.758	.98249	20.20328	.15905	820.2	1.758	.98249	20.20328	.15905	820.2	1.758	.98249	20.20328	.15905
2	0	.200	.025	.0500	818.6	1.755	.98058	20.16389	.16763	818.6	1.755	.98058	20.16389	.16763	820.2	1.758	.98249	20.20328	.15905
3	0	.400	.050	.1000	818.6	1.755	.98058	20.16389	.16763	818.6	1.755	.98058	20.16389	.16763	820.2	1.758	.98249	20.20328	.15905
4	0	.600	.075	.1500	818.6	1.755	.98058	20.16389	.16763	818.6	1.755	.98058	20.16389	.16763	820.2	1.758	.98249	20.20328	.15905
5	0	.800	.100	.2000	818.6	1.755	.98058	20.16389	.16763	818.6	1.755	.98058	20.16389	.16763	820.2	1.758	.98249	20.20328	.15905
6	0	1.000	.125	.2500	817.0	1.751	.97866	20.12451	.17581	815.4	1.747	.97675	20.08513	.18365	817.0	1.751	.97866	20.12451	.17581
7	0	1.200	.150	.3000	813.8	1.744	.97483	20.04575	.19118	813.8	1.744	.97483	20.04575	.19118	815.4	1.747	.97675	20.08513	.18365
8	0	1.400	.175	.3500	812.2	1.740	.97291	20.00636	.19845	812.2	1.740	.97291	20.00636	.19845	813.8	1.744	.97483	20.04575	.19118
9	0	1.600	.200	.4000	807.4	1.729	.96717	19.88822	.21890	807.4	1.729	.96717	19.88822	.21890	810.6	1.737	.97100	19.96698	.20547
10	0	1.800	.225	.4500	804.2	1.722	.96334	19.80945	.23161	804.2	1.722	.96334	19.80945	.23161	805.8	1.726	.96525	19.84883	.22533
11	0	2.000	.250	.5000	799.4	1.711	.95759	19.69130	.24957	799.4	1.711	.95759	19.69130	.24957	802.6	1.719	.96142	19.77007	.23773
12	0	2.200	.275	.5500	794.6	1.701	.95185	19.57315	.26646	794.6	1.701	.95185	19.57315	.26646	797.8	1.708	.95568	19.65192	.25531
13	0	2.400	.300	.6000	788.2	1.686	.94419	19.41562	.28761	788.2	1.686	.94419	19.41562	.28761	791.4	1.693	.94802	19.49439	.27721
14	0	2.600	.325	.6500	780.2	1.668	.93461	19.21871	.31232	780.2	1.668	.93461	19.21871	.31232	783.4	1.675	.93844	19.29748	.30264
15	0	2.800	.350	.7000	772.2	1.650	.92504	19.02180	.33551	772.2	1.650	.92504	19.02180	.33551	775.4	1.657	.92887	19.10056	.32640
16	0	3.000	.375	.7500	759.4	1.621	.90971	18.70674	.37017	759.4	1.621	.90971	18.70674	.37017	764.2	1.632	.91546	18.82488	.35748
17	0	3.230	.400	.8000	745.0	1.589	.89248	18.35229	.40642	746.6	1.592	.89439	18.39168	.40251	749.8	1.600	.89822	18.47044	.39461
18	0	3.430	.425	.8500	727.4	1.549	.87141	17.91908	.44783	727.4	1.549	.87141	17.91908	.44783	730.6	1.556	.87524	17.99785	.44050
19	0	3.600	.450	.9000	697.1	1.481	.83502	17.17082	.51612	698.7	1.484	.83694	17.21020	.51076	701.9	1.491	.84077	17.28896	.50400
20	0	3.800	.475	.9500	649.1	1.372	.77757	15.98934	.61044	650.7	1.376	.77948	16.02872	.60734	653.9	1.383	.78331	16.10749	.60113
21	180	.200	.025	.0500	828.8	1.778	.99288	20.41689	.10109	828.8	1.778	.99288	20.41689	.10109	827.2	1.774	.99097	20.37755	.11394
22	180	.400	.050	.1000	827.2	1.774	.99097	20.37755	.11394	827.2	1.774	.99097	20.37755	.11394	827.2	1.774	.99097	20.37755	.11394
23	180	.600	.075	.1500	827.2	1.774	.99097	20.37755	.11394	827.2	1.774	.99097	20.37755	.11394	824.1	1.767	.98714	20.29887	.13611
24	180	.800	.100	.2000	825.7	1.771	.98905	20.33821	.12550	825.7	1.771	.98905	20.33821	.12550	824.1	1.767	.98714	20.29887	.13611
25	180	1.000	.125	.2500	824.1	1.767	.98714	20.29887	.13611	824.1	1.767	.98714	20.29887	.13611	824.1	1.767	.98714	20.29887	.13611
26	180	1.230	.150	.3000	824.1	1.767	.98714	20.29887	.13611	824.1	1.767	.98714	20.29887	.13611	822.5	1.763	.98523	20.25953	.14597
27	180	1.400	.175	.3500	824.1	1.767	.98714	20.29887	.13611	822.5	1.763	.98523	20.25953	.14597	820.9	1.760	.98331	20.22019	.15523
28	180	1.630	.200	.4000	822.5	1.763	.98523	20.25953	.14597	820.9	1.760	.98331	20.22019	.15523	819.3	1.756	.98140	20.18085	.16399
29	180	1.800	.225	.4500	820.9	1.760	.98331	20.22019	.15523	819.3	1.756	.98140	20.18085	.16399	816.1	1.749	.97757	20.10217	.18030
30	180	2.000	.250	.5000	817.7	1.753	.97949	20.14151	.17233	816.1	1.749	.97757	20.10217	.18030	814.5	1.745	.97566	20.06284	.18795
31	180	2.200	.275	.5500	816.1	1.749	.97757	20.10217	.18030	812.9	1.742	.97375	20.02350	.19532	811.3	1.738	.97184	19.98416	.20244
32	180	2.400	.300	.6000	812.9	1.742	.97375	20.02350	.19532	809.7	1.735	.96992	19.94482	.20933	806.5	1.727	.96610	19.86614	.22253
33	180	2.600	.325	.6500	808.1	1.731	.96801	19.90548	.21602	804.9	1.724	.96418	19.82680	.22886	803.1	1.713	.95844	19.70879	.24699
34	180	2.800	.350	.7000	801.7	1.717	.96036	19.74812	.24108	798.5	1.709	.95653	19.66945	.25277	795.3	1.702	.95270	19.59077	.26400
35	180	3.000	.375	.7500	793.7	1.699	.95079	19.55143	.26946	790.5	1.691	.94697	19.47275	.28010	785.7	1.681	.94123	19.35474	.29544
36	180	3.200	.400	.8000	784.1	1.677	.93931	19.31540	.30040	779.3	1.666	.93357	19.19738	.31490	774.5	1.655	.92783	19.07936	.32887
37	180	3.400	.425	.8500	768.2	1.641	.92018	18.92201	.34678	763.4	1.630	.91444	18.80399	.35975	758.6	1.619	.90870	18.68597	.37236
38	180	3.600	.450	.9000	742.6	1.583	.88957	18.29259	.41230	737.8	1.573	.88383	18.17457	.42374	731.4	1.558	.87618	18.01721	.43868
39	180	3.830	.475	.9500	699.5	1.486	.83792	17.23044	.50903	694.7	1.475	.83218	17.11242	.51908	686.7	1.457	.82262	16.91572	.53561
40	270	1.300	.125	.2500	822.5	1.763	.98523	20.25953	.14597	824.1	1.767	.98714	20.29887	.13611	825.7	1.771	.98905	20.33821	.12550
41	270	2.000	.250	.5000	808.1	1.731	.96801	19.90548	.21602	812.9	1.742	.97375	20.02350	.19532	815.1	1.749	.97757	20.10217	.18030
42	270	3.000	.375	.7500	774.5	1.655	.92783	19.07936	.32987	779.3	1.666	.93357	19.19738	.31490	787.3	1.684	.94314	19.39407	.29040
43	90	1.300	.125	.2500	818.6	1.755	.98058	20.16389	.16763	817.0	1.751	.97866	20.12451	.17581	817.0	1.751	.97866	20.12451	.17581
44	90	2.300	.250	.5000	805.8	1.726	.96525	19.84883	.22533	802.6	1.719	.96142	19.77007	.23773	801.0	1.715	.95951	19.73068	.24372
45	90	3.300	.375	.7500	772.2	1.650	.92504	19.02180	.33551	767.4	1.639	.91929	18.90365	.34882	764.2	1.632	.91546	18.82488	.35748

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE XI.- DATA[a] FOR 180° CONE; $M_\infty = 3.95$ - Continued

(b) $\alpha = 5°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 5765.1 psf					Φ = 90.0°, p_t = 5755.6 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	820.1	1.758	.98242	20.20187	.15937	820.1	1.761	.98404	20.23518	.15177
2	0	.200	.025	.0500	818.5	1.755	.98051	20.16249	.16793	820.1	1.761	.98404	20.23518	.15177
3	0	.400	.050	.1000	818.5	1.755	.98051	20.16249	.16793	820.1	1.761	.98404	20.23518	.15177
4	0	.600	.075	.1500	818.5	1.755	.98051	20.16249	.16793	820.1	1.761	.98404	20.23518	.15177
5	0	.800	.100	.2000	818.5	1.755	.98051	20.16249	.16793	820.1	1.761	.98404	20.23518	.15177
6	0	1.000	.125	.2500	816.9	1.751	.97859	20.12311	.17610	820.1	1.761	.98404	20.23518	.15177
7	0	1.200	.150	.3000	815.3	1.747	.97668	20.08373	.18392	815.9	1.754	.98021	20.15629	.16924
8	0	1.400	.175	.3500	813.7	1.744	.97476	20.04435	.19144	815.3	1.750	.97829	20.11685	.17736
9	0	1.600	.200	.4000	813.5	1.736	.97093	19.96559	.20572	813.7	1.747	.97637	20.07740	.18515
10	0	1.800	.225	.4500	807.3	1.729	.96710	19.88683	.21913	810.5	1.740	.97253	19.99851	.19986
11	0	2.000	.250	.5000	802.5	1.718	.96136	19.76869	.23794	805.7	1.729	.96678	19.88018	.22023
12	0	2.200	.275	.5500	797.7	1.708	.95561	19.65055	.25551	800.9	1.718	.96102	19.76184	.23899
13	0	2.400	.300	.6000	792.9	1.697	.94987	19.53241	.27206	795.1	1.707	.95527	19.64351	.25652
14	0	2.600	.325	.6500	784.9	1.679	.94029	19.33551	.29787	789.7	1.693	.94760	19.48573	.27837
15	0	2.800	.350	.7000	777.0	1.661	.93072	19.13862	.32192	781.7	1.675	.93801	19.28851	.30376
16	0	3.000	.375	.7500	765.8	1.636	.91731	18.86296	.35331	770.6	1.649	.92458	19.01239	.33659
17	0	3.200	.400	.8000	751.4	1.603	.90008	18.50854	.39074	757.8	1.620	.90923	18.69683	.37121
18	0	3.400	.425	.8500	733.8	1.563	.87901	18.07536	.43320	740.2	1.581	.88813	18.26294	.41519
19	0	3.600	.450	.9000	706.6	1.502	.84645	17.40590	.49387	713.0	1.519	.85552	17.59238	.47745
20	0	3.800	.475	.9500	658.7	1.394	.78900	16.22451	.59184	665.0	1.411	.79798	16.40904	.57708
21	180	.200	.025	.0500	828.1	1.776	.99200	20.39877	.10720	827.2	1.777	.99253	20.40973	.10355
22	180	.400	.050	.1000	826.5	1.773	.99008	20.35939	.11941	825.6	1.774	.99061	20.37033	.11614
23	180	.600	.075	.1500	824.9	1.769	.98817	20.32001	.13051	824.0	1.770	.98870	20.33093	.12753
24	180	.800	.100	.2000	824.9	1.769	.98817	20.32001	.13051	822.4	1.766	.98678	20.29152	.13800
25	180	1.000	.125	.2500	823.3	1.765	.98625	20.28063	.14076	822.4	1.766	.98678	20.29152	.13800
26	180	1.200	.150	.3000	821.7	1.762	.98434	20.24125	.15034	819.2	1.759	.98295	20.21272	.15693
27	180	1.400	.175	.3500	818.5	1.755	.98051	20.16249	.16793	817.6	1.756	.98103	20.17332	.16562
28	180	1.600	.200	.4000	815.9	1.751	.97859	20.12311	.17610	814.4	1.748	.97720	20.09452	.18181
29	180	1.800	.225	.4500	815.3	1.747	.97668	20.08373	.18392	811.2	1.741	.97337	20.01572	.19674
30	180	2.000	.250	.5000	812.1	1.740	.97285	20.00497	.19870	808.0	1.734	.96954	19.93692	.21069
31	180	2.200	.275	.5500	807.3	1.729	.96710	19.88683	.21913	804.8	1.727	.96571	19.85811	.22383
32	180	2.400	.300	.6000	800.9	1.715	.95944	19.72931	.24392	798.4	1.712	.95804	19.70051	.24822
33	180	2.600	.325	.6500	796.1	1.704	.95370	19.61117	.26113	792.1	1.698	.95038	19.54291	.27063
34	180	2.800	.350	.7000	789.7	1.690	.94604	19.45365	.28263	784.1	1.680	.94080	19.34590	.29656
35	180	3.000	.375	.7500	780.1	1.668	.93455	19.21738	.31249	772.9	1.655	.92738	19.07009	.32995
36	180	3.200	.400	.8000	767.4	1.639	.91923	18.90234	.34897	763.1	1.626	.91206	18.75489	.36504
37	180	3.400	.425	.8500	751.4	1.603	.90008	18.50854	.39074	742.6	1.586	.89098	18.32147	.40946
38	180	3.600	.450	.9000	724.2	1.542	.86752	17.83908	.45520	715.4	1.525	.85840	17.65166	.47217
39	180	3.800	.475	.9500	679.4	1.441	.81390	16.73644	.55045	669.1	1.420	.80284	16.50903	.56901
40	270	1.000	.125	.2500	824.9	1.769	.98817	20.32001	.13051	824.0	1.770	.98870	20.33093	.12753
41	270	2.000	.250	.5000	818.5	1.755	.98051	20.16249	.16793	817.6	1.756	.98103	20.17332	.16562
42	270	3.000	.375	.7500	796.1	1.704	.95370	19.61117	.26113	795.3	1.705	.95421	19.62171	.25984
43	90	1.000	.125	.2500	815.3	1.747	.97668	20.08373	.18392	815.9	1.754	.98021	20.15629	.16924
44	90	2.000	.250	.5000	799.3	1.711	.95753	19.68993	.24978	799.3	1.714	.95911	19.72240	.24496
45	90	3.000	.375	.7500	759.4	1.621	.90965	18.70544	.37030	759.4	1.624	.91115	18.73628	.36703

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE XI.- DATA[a] FOR 180° CONE; $M_\infty = 3.95$ - Continued

(c) $\alpha = 10°$

Orifice	θ, deg	s, in.	s/D	s/s*	$\Phi = 0.0°$, $p_t = 5765.1$ psf					$\Phi = 22.5°$, $p_t = 5765.1$ psf					$\Phi = 45.0°$, $p_t = 5765.1$ psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	815.4	1.747	.97675	20.08513	.18365	816.1	1.749	.97757	20.10217	.18030	815.3	1.747	.97668	20.08373	.18392
2	0	.020	.025	.0500	813.8	1.744	.97483	20.04575	.19118	812.9	1.742	.97375	20.02350	.19532	812.1	1.740	.97285	20.00497	.19870
3	0	.040	.050	.1000	810.6	1.737	.97100	19.96698	.20547	811.3	1.738	.97184	19.98416	.20244	810.5	1.736	.97093	19.96559	.20572
4	0	.060	.075	.1500	809.0	1.733	.96908	19.92760	.21238	809.7	1.735	.96992	19.94482	.20933	808.9	1.733	.96902	19.92621	.21252
5	0	.080	.100	.2000	805.8	1.726	.96525	19.84883	.22533	806.5	1.727	.96610	19.86614	.22253	808.9	1.733	.96902	19.92621	.21252
6	0	1.000	.125	.2500	802.6	1.719	.96142	19.77007	.23773	803.3	1.720	.96227	19.78746	.23505	804.1	1.722	.96327	19.80807	.23183
7	0	1.200	.150	.3000	799.4	1.711	.95759	19.69130	.24957	800.1	1.713	.95844	19.70879	.24699	802.5	1.718	.96136	19.76869	.23794
8	0	1.400	.175	.3500	796.6	1.701	.95185	19.57315	.26646	795.3	1.702	.95270	19.59077	.26400	799.3	1.711	.95753	19.68993	.24978
9	0	1.600	.200	.4000	789.8	1.690	.94610	19.45501	.28245	792.1	1.695	.94888	19.51209	.27482	796.1	1.704	.95370	19.61117	.26113
10	0	1.800	.225	.4500	785.0	1.679	.94036	19.33686	.29770	785.7	1.681	.94123	19.35474	.29544	789.7	1.690	.94604	19.45365	.28263
11	0	2.000	.250	.5000	778.6	1.665	.93270	19.17933	.31707	779.3	1.666	.93357	19.19738	.31490	784.9	1.679	.94029	19.33551	.29787
12	0	2.200	.275	.5500	773.8	1.654	.92695	19.06118	.33098	774.5	1.655	.92783	19.07936	.32887	780.1	1.668	.93455	19.21738	.31249
13	0	2.400	.300	.6000	765.8	1.636	.91737	18.86427	.35317	768.2	1.641	.92018	18.92201	.34678	773.8	1.654	.92689	19.05986	.33113
14	0	2.600	.325	.6500	756.2	1.614	.90588	18.62797	.37844	758.6	1.619	.90870	18.68597	.37236	765.8	1.636	.91731	18.86296	.35331
15	0	2.800	.350	.7000	748.6	1.592	.89639	18.39168	.40251	749.0	1.598	.89723	18.44994	.39667	756.2	1.614	.90582	18.62668	.37858
16	0	3.000	.375	.7500	733.8	1.564	.87907	18.07662	.43308	736.2	1.569	.88192	18.13523	.42751	743.4	1.585	.89050	18.31164	.41043
17	0	3.200	.400	.8000	717.9	1.527	.85992	17.68279	.46937	720.2	1.533	.86279	17.74184	.46405	729.0	1.553	.87326	17.95722	.44429
18	0	3.400	.425	.8500	698.7	1.484	.83694	17.21020	.51076	701.1	1.490	.83983	17.26977	.50565	709.8	1.509	.85028	17.48466	.48698
19	0	3.600	.450	.9000	669.9	1.419	.80246	16.50131	.56963	673.9	1.428	.80731	16.60101	.56154	681.0	1.444	.81581	16.77582	.54721
20	0	3.800	.475	.9500	623.5	1.315	.74692	15.35922	.65933	627.6	1.324	.75183	15.46019	.65158	633.1	1.336	.75836	15.59443	.64122
21	180	.200	.025	.0500	824.1	1.767	.98714	20.29887	.13611	824.1	1.767	.98714	20.29887	.13611	824.0	1.767	.98707	20.29746	.13647
22	180	.400	.050	.1000	825.7	1.771	.98905	20.33821	.12550	825.7	1.771	.98905	20.33821	.12550	824.0	1.767	.98707	20.29746	.13647
23	180	.600	.075	.1500	825.7	1.771	.98905	20.33821	.12550	825.7	1.771	.98905	20.33821	.12550	824.0	1.767	.98707	20.29746	.13647
24	180	.800	.100	.2000	827.2	1.774	.99097	20.37755	.11394	827.2	1.774	.99097	20.37755	.11394	824.0	1.767	.98707	20.29746	.13647
25	180	1.000	.125	.2500	828.8	1.778	.99288	20.41689	.10109	827.2	1.774	.99097	20.37755	.11394	824.0	1.767	.98707	20.29746	.13647
26	180	1.200	.150	.3000	830.4	1.781	.99479	20.45622	.08640	828.8	1.778	.99288	20.41689	.10109	825.6	1.770	.98898	20.33679	.12590
27	180	1.400	.175	.3500	832.0	1.785	.99670	20.49556	.06868	828.8	1.778	.99288	20.41689	.10109	825.6	1.770	.98898	20.33679	.12590
28	180	1.600	.200	.4000	832.0	1.785	.99670	20.49556	.06868	828.8	1.778	.99288	20.41689	.10109	824.0	1.767	.98707	20.29746	.13647
29	180	1.800	.225	.4500	832.0	1.785	.99670	20.49556	.06868	830.4	1.781	.99479	20.45622	.08640	824.0	1.767	.98707	20.29746	.13647
30	180	2.000	.250	.5000	832.0	1.785	.99670	20.49556	.06868	828.8	1.778	.99288	20.41689	.10109	822.4	1.763	.98516	20.25812	.14631
31	180	2.200	.275	.5500	830.4	1.781	.99479	20.45622	.08640	827.2	1.774	.99097	20.37755	.11394	820.8	1.760	.98325	20.21879	.15555
32	180	2.400	.300	.6000	828.8	1.778	.99288	20.41689	.10109	825.7	1.771	.98905	20.33821	.12550	817.6	1.752	.97942	20.14011	.17262
33	180	2.600	.325	.6500	825.7	1.771	.98905	20.33821	.12550	822.5	1.763	.98523	20.25953	.14597	812.8	1.742	.97368	20.02211	.19557
34	180	2.800	.350	.7000	820.9	1.760	.98331	20.22019	.15523	817.7	1.753	.97949	20.14151	.17233	808.0	1.731	.96794	19.90410	.21625
35	180	3.000	.375	.7500	816.1	1.749	.97757	20.10217	.18030	811.3	1.738	.97184	19.98416	.20244	800.0	1.713	.95838	19.70742	.24719
36	180	3.200	.400	.8000	806.5	1.727	.96610	19.86614	.22253	801.7	1.717	.96036	19.74812	.24108	790.5	1.691	.94690	19.47140	.28028
37	180	3.400	.425	.8500	793.7	1.699	.95079	19.55143	.26946	788.9	1.688	.94505	19.43341	.28529	774.5	1.655	.92777	19.07804	.32902
38	180	3.600	.450	.9000	771.4	1.648	.92401	19.00069	.33792	766.6	1.637	.91827	18.88267	.35114	750.5	1.601	.89908	18.48800	.39283
39	180	3.800	.475	.9500	729.8	1.555	.87427	17.97787	.44236	723.4	1.540	.86662	17.82052	.45689	705.8	1.500	.84551	17.38658	.49555
40	270	1.000	.125	.2500	817.7	1.753	.97949	20.14151	.17233	822.5	1.763	.98523	20.25953	.14597	825.6	1.770	.98898	20.33679	.12590
41	270	2.000	.250	.5000	806.5	1.727	.96610	19.86614	.22253	814.5	1.745	.97566	20.06284	.18795	824.0	1.767	.98707	20.29746	.13647
42	270	3.000	.375	.7500	771.4	1.648	.92401	19.00069	.33792	785.7	1.681	.94123	19.35474	.29544	800.0	1.713	.95838	19.70742	.24719
43	90	1.000	.125	.2500	812.2	1.740	.97291	20.00636	.19845	808.1	1.731	.96801	19.90548	.21602	804.1	1.722	.96327	19.80807	.23183
44	90	2.000	.250	.5000	801.0	1.715	.95951	19.73068	.24372	792.1	1.695	.94888	19.51209	.27482	784.9	1.679	.94029	19.33551	.29787
45	90	3.000	.375	.7500	767.4	1.639	.91929	18.90365	.34882	755.4	1.612	.90488	18.60730	.38059	743.4	1.585	.89050	18.31164	.41043

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE XI.- DATA[a] FOR 180° CONE; $M_\infty = 3.95$ - Continued

(c) $\alpha = 10°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 5755.6 psf					Φ = 90.0°, p_t = 5755.6 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	814.6	1.749	.97746	20.09974	.18078	815.3	1.750	.97829	20.11685	.17736
2	0	.230	.025	.0500	813.0	1.745	.97554	20.06025	.18844	815.3	1.750	.97829	20.11685	.17736
3	0	.430	.050	.1000	813.0	1.745	.97554	20.06025	.18844	815.3	1.750	.97829	20.11685	.17736
4	0	.630	.075	.1500	811.4	1.742	.97361	20.02076	.19582	815.3	1.750	.97829	20.11685	.17736
5	0	.800	.100	.2000	809.8	1.738	.97169	19.98127	.20295	813.7	1.747	.97637	20.07740	.18515
6	0	1.000	.125	.2500	808.2	1.734	.96977	19.94178	.20985	813.7	1.747	.97637	20.07740	.18515
7	0	1.200	.150	.3000	805.0	1.727	.96593	19.86280	.22307	810.5	1.740	.97253	19.99851	.19986
8	0	1.430	.175	.3500	803.4	1.723	.96401	19.82331	.22942	808.9	1.736	.97061	19.95907	.20685
9	0	1.600	.200	.4000	800.2	1.716	.96017	19.74434	.24166	807.3	1.732	.96870	19.91962	.21364
10	0	1.830	.225	.4500	797.0	1.709	.95633	19.66536	.25337	804.1	1.725	.96486	19.84073	.22664
11	0	2.000	.250	.5000	792.2	1.698	.95057	19.54689	.27008	803.9	1.718	.96102	19.76184	.23899
12	0	2.230	.275	.5500	787.4	1.687	.94481	19.42843	.28594	796.1	1.707	.95527	19.64351	.25652
13	0	2.430	.300	.6000	782.6	1.676	.93905	19.30996	.30108	791.3	1.696	.94951	19.52518	.27305
14	0	2.600	.325	.6500	774.6	1.658	.92945	19.11252	.32500	786.9	1.682	.94184	19.36740	.29383
15	0	2.830	.350	.7000	766.6	1.640	.91985	18.91508	.34755	777.0	1.664	.93225	19.17017	.31817
16	0	3.030	.375	.7500	755.4	1.615	.90640	18.63865	.37733	767.4	1.642	.92074	18.93350	.34550
17	0	3.200	.400	.8000	739.4	1.579	.88720	18.24377	.41706	753.0	1.609	.90348	18.57850	.38357
18	0	3.400	.425	.8500	721.8	1.539	.86608	17.80939	.45791	735.4	1.570	.88238	18.14461	.42661
19	0	3.600	.450	.9000	694.6	1.478	.83343	17.13808	.51690	708.2	1.508	.84977	17.47405	.48791
20	0	3.800	.475	.9500	646.6	1.369	.77582	15.95342	.61327	661.8	1.404	.79414	16.33015	.58341
21	180	.200	.025	.0500	822.4	1.766	.98678	20.29152	.13800	820.8	1.763	.98487	20.25212	.14776
22	180	.400	.050	.1000	822.4	1.766	.98678	20.29152	.13800	820.8	1.763	.98487	20.25212	.14776
23	180	.630	.075	.1500	822.4	1.766	.98678	20.29152	.13800	817.6	1.756	.98103	20.17332	.16562
24	180	.800	.100	.2000	820.8	1.763	.98487	20.25212	.14776	817.6	1.756	.98103	20.17332	.16562
25	180	1.000	.125	.2500	820.8	1.763	.98487	20.25212	.14776	816.0	1.752	.97912	20.13392	.17389
26	180	1.200	.150	.3000	819.2	1.759	.98295	20.21272	.15693	814.4	1.748	.97720	20.09452	.18181
27	180	1.400	.175	.3500	819.2	1.759	.98295	20.21272	.15693	811.2	1.741	.97337	20.01572	.19674
28	180	1.630	.200	.4000	816.0	1.752	.97912	20.13392	.17389	811.2	1.741	.97337	20.01572	.19674
29	180	1.800	.225	.4500	814.4	1.748	.97720	20.09452	.18181	808.0	1.734	.96954	19.93692	.21069
30	180	2.000	.250	.5000	811.2	1.741	.97337	20.01572	.19674	803.2	1.723	.96379	19.81871	.23015
31	180	2.200	.275	.5500	809.6	1.737	.97145	19.97632	.20383	800.0	1.716	.95996	19.73991	.24233
32	180	2.400	.300	.6000	806.4	1.730	.96762	19.89751	.21735	795.3	1.705	.95421	19.62171	.25964
33	180	2.600	.325	.6500	800.0	1.716	.95996	19.73991	.24233	787.3	1.687	.94463	19.42470	.28643
34	180	2.800	.350	.7000	792.1	1.698	.95038	19.54291	.27063	780.9	1.673	.93696	19.26710	.30641
35	180	3.000	.375	.7500	784.1	1.680	.94080	19.34590	.29656	769.7	1.647	.92355	18.99129	.33899
36	180	3.200	.400	.8000	772.9	1.655	.92738	19.07009	.32995	758.5	1.622	.91014	18.71548	.36924
37	180	3.400	.425	.8500	756.9	1.618	.90822	18.67608	.37340	739.4	1.579	.88715	18.24267	.41716
38	180	3.600	.450	.9000	731.4	1.561	.87757	18.04567	.43601	712.2	1.517	.85457	17.57285	.47919
39	180	3.800	.475	.9500	686.7	1.460	.82392	16.94244	.53338	665.9	1.413	.79901	16.43023	.57537
40	270	1.000	.125	.2500	827.2	1.777	.99253	20.40973	.10355	828.8	1.781	.99445	20.44913	.08923
41	270	2.000	.250	.5000	828.8	1.781	.99445	20.44913	.08923	830.4	1.784	.99636	20.48853	.07217
42	270	3.000	.375	.7500	811.2	1.741	.97337	20.01572	.19674	816.0	1.752	.97912	20.13392	.17389
43	90	1.000	.125	.2500	801.8	1.723	.96209	19.78383	.23561	800.9	1.718	.96102	19.76184	.23899
44	90	2.000	.250	.5000	779.4	1.669	.93521	19.23098	.31083	778.6	1.667	.93417	19.20962	.31343
45	90	3.000	.375	.7500	736.2	1.572	.88316	18.16479	.42468	733.8	1.566	.88046	18.10516	.43037

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE XI.- DATA[a] FOR 180° CONE; $M_\infty = 3.95$ - Continued

(d) $\alpha = 15°$

Orifice	θ, deg	s, in.	s/D	s/s*	$\Phi = 0.0°$, $p_t = 5765.1$ psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	802.6	1.719	.96142	19.77007	.23773
2	0	.200	.025	.0500	799.4	1.711	.95759	19.69130	.24957
3	0	.400	.050	.1000	798.2	1.734	.95376	19.61254	.26094
4	0	.600	.075	.1500	793.0	1.697	.94993	19.53377	.27188
5	0	.800	.100	.2000	789.8	1.690	.94610	19.45501	.28245
6	0	1.000	.125	.2500	786.6	1.683	.94227	19.37624	.29270
7	0	1.200	.150	.3000	781.8	1.672	.93653	19.25809	.30751
8	0	1.400	.175	.3500	777.0	1.661	.93078	19.13995	.32176
9	0	1.600	.200	.4000	772.2	1.650	.92504	19.02180	.33551
10	0	1.800	.225	.4500	765.8	1.636	.91737	18.86427	.35317
11	0	2.000	.250	.5000	759.4	1.621	.90971	18.70674	.37017
12	0	2.200	.275	.5500	753.0	1.607	.90205	18.54921	.38659
13	0	2.400	.300	.6000	745.0	1.589	.89248	18.35229	.40642
14	0	2.600	.325	.6500	735.4	1.567	.88099	18.11600	.42934
15	0	2.800	.350	.7000	724.2	1.542	.86758	17.84032	.45508
16	0	3.000	.375	.7500	709.9	1.509	.85034	17.48588	.48687
17	0	3.200	.400	.8000	695.5	1.477	.83311	17.13143	.51747
18	0	3.400	.425	.8500	674.7	1.430	.80821	16.61946	.56003
19	0	3.600	.450	.9000	647.5	1.369	.77565	15.94995	.61354
20	0	3.800	.475	.9500	602.7	1.268	.72203	14.84724	.69829
21	180	.200	.025	.0500	811.3	1.738	.97184	19.98416	.20244
22	180	.400	.050	.1000	814.5	1.745	.97566	20.06284	.18795
23	180	.600	.075	.1500	815.1	1.749	.97757	20.10217	.18030
24	180	.800	.100	.2000	817.7	1.753	.97949	20.14151	.17233
25	180	1.000	.125	.2500	820.9	1.760	.98331	20.22019	.15523
26	180	1.200	.150	.3000	822.5	1.763	.98523	20.25953	.14597
27	180	1.400	.175	.3500	824.1	1.767	.98714	20.29887	.13611
28	180	1.600	.200	.4000	827.2	1.774	.99097	20.37755	.11394
29	180	1.800	.225	.4500	828.8	1.778	.99288	20.41689	.10109
30	180	2.000	.250	.5000	830.4	1.781	.99479	20.45622	.08640
31	180	2.200	.275	.5500	832.0	1.785	.99670	20.49556	.06868
32	180	2.400	.300	.6000	832.0	1.785	.99670	20.49556	.06868
33	180	2.600	.325	.6500	832.0	1.785	.99670	20.49556	.06868
34	180	2.800	.350	.7000	832.0	1.785	.99670	20.49556	.06868
35	180	3.000	.375	.7500	830.4	1.781	.99479	20.45622	.08640
36	180	3.200	.400	.8000	825.7	1.771	.98905	20.33821	.12550
37	180	3.400	.425	.8500	816.1	1.749	.97757	20.10217	.18030
38	180	3.600	.450	.9000	800.1	1.713	.95844	19.70879	.24699
39	180	3.800	.475	.9500	763.4	1.630	.91444	18.80399	.35975
40	270	1.000	.125	.2500	804.9	1.724	.96418	19.82680	.22886
41	270	2.000	.250	.5000	792.1	1.695	.94888	19.51209	.27482
42	270	3.000	.375	.7500	763.4	1.630	.91444	18.80399	.35975
43	90	1.000	.125	.2500	799.4	1.711	.95759	19.69130	.24957
44	90	2.000	.250	.5000	788.2	1.686	.94419	19.41562	.28761
45	90	3.000	.375	.7500	756.2	1.614	.90588	18.62797	.37844

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE XI.- DATA[a] FOR 180° CONE; $M_\infty = 3.95$ - Continued

(e) $\alpha = 20°$

Orifice	e, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 5765.1 psf					Φ = 22.5°, p_t = 5765.1 psf					Φ = 45.0°, p_t = 5765.1 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.200	.000	.0000	788.2	1.686	.94419	19.41562	.28761	788.2	1.686	.94419	19.41562	.28761	788.1	1.686	.94412	19.41427	.28779
2	0	.230	.025	.0500	783.4	1.675	.93844	19.29748	.30264	783.4	1.675	.93844	19.29748	.30264	783.3	1.675	.93838	19.29613	.30281
3	0	.430	.050	.1000	780.2	1.668	.93461	19.21871	.31232	780.2	1.668	.93461	19.21871	.31232	780.1	1.668	.93455	19.21738	.31249
4	0	.630	.075	.1500	775.4	1.657	.92887	19.10056	.32640	777.0	1.661	.93078	19.13995	.32176	778.6	1.664	.93263	19.17800	.31723
5	0	.800	.100	.2000	772.2	1.650	.92504	19.02180	.33551	773.8	1.654	.92695	19.06118	.33098	775.4	1.657	.92880	19.09924	.32655
6	0	1.000	.125	.2500	767.4	1.639	.91929	18.90365	.34882	767.4	1.639	.91929	18.90365	.34882	772.2	1.650	.92497	19.02048	.33566
7	0	1.200	.150	.30 ?	762.6	1.628	.91354	18.78550	.36175	764.2	1.632	.91546	18.82488	.35748	769.0	1.643	.92114	18.94172	.34458
8	0	1.400	.175	.3500	757.8	1.618	.90780	18.66735	.37432	757.8	1.618	.90780	18.66735	.37432	764.2	1.632	.91540	18.82358	.35762
9	0	1.600	.200	.4000	751.4	1.603	.90014	18.50982	.39061	753.0	1.607	.90205	18.54921	.38659	759.4	1.621	.90965	18.70544	.37030
10	0	1.800	.225	.4500	743.4	1.585	.89056	18.31291	.41030	746.6	1.592	.89439	18.39168	.40251	753.0	1.607	.90199	18.54792	.38672
11	0	2.000	.250	.5000	737.0	1.571	.88290	18.15538	.42558	738.6	1.574	.88482	18.19476	.42180	746.6	1.592	.89433	18.39040	.40264
12	0	2.200	.275	.5500	730.6	1.556	.87524	17.99785	.44050	732.2	1.560	.87716	18.03723	.43680	740.2	1.578	.88667	18.23288	.41811
13	0	2.430	.300	.6000	721.0	1.535	.86375	17.76155	.46226	722.6	1.538	.86566	17.80094	.45868	732.2	1.560	.87709	18.03598	.43692
14	0	2.600	.325	.6500	711.5	1.513	.85226	17.52526	.48340	713.1	1.517	.85417	17.56464	.47992	722.6	1.538	.86560	17.79970	.45879
15	0	2.830	.350	.7000	700.3	1.488	.83885	17.24958	.50738	703.5	1.495	.84268	17.32835	.50060	713.0	1.517	.85411	17.56342	.48003
16	0	3.000	.375	.7500	687.5	1.459	.82353	16.93452	.53404	690.7	1.466	.82736	17.01328	.52745	700.2	1.488	.83879	17.24838	.50749
17	0	3.230	.400	.8000	671.5	1.423	.80438	16.54069	.56644	674.7	1.430	.80821	16.61946	.56003	685.8	1.455	.82156	16.89396	.53742
18	0	3.430	.425	.8500	652.3	1.380	.78140	16.06810	.60424	655.5	1.387	.78523	16.14687	.59801	666.6	1.412	.79858	16.42140	.57608
19	0	3.600	.450	.9000	626.7	1.322	.75075	15.43798	.65328	628.3	1.326	.75267	15.47736	.65025	639.5	1.351	.76602	15.75195	.62901
20	0	3.800	.475	.9500	583.6	1.225	.69904	14.37465	.73387	585.2	1.228	.70096	14.41403	.73092	596.3	1.253	.71432	14.68869	.71026
21	180	.230	.025	.0500	798.5	1.709	.95653	19.66945	.25277	798.5	1.709	.95653	19.66945	.25277	798.4	1.709	.95646	19.66808	.25297
22	180	.400	.050	.1000	800.1	1.713	.95844	19.70879	.24699	800.1	1.713	.95844	19.70879	.24699	798.4	1.709	.95646	19.66808	.25297
23	180	.600	.075	.1500	803.3	1.720	.96227	19.78746	.23505	803.3	1.720	.96227	19.78746	.23505	800.0	1.713	.95838	19.70742	.24719
24	180	.800	.100	.2000	806.5	1.727	.96610	19.86614	.22253	806.5	1.727	.96610	19.86614	.22253	801.6	1.716	.96029	19.74675	.24129
25	180	1.000	.125	.2500	809.7	1.735	.96992	19.94482	.20933	808.1	1.731	.96801	19.90548	.21602	804.8	1.724	.96412	19.82542	.22908
26	180	1.200	.150	.3000	814.5	1.745	.97566	20.06284	.18795	811.3	1.738	.97184	19.98416	.20244	806.4	1.727	.96603	19.86476	.22275
27	180	1.400	.175	.3500	816.1	1.749	.97757	20.10217	.18030	814.5	1.745	.97566	20.06284	.18795	808.0	1.731	.96794	19.90410	.21625
28	180	1.600	.200	.4000	820.9	1.760	.98331	20.22019	.15523	816.1	1.749	.97757	20.10217	.18030	808.0	1.731	.96794	19.90410	.21625
29	180	1.800	.225	.4500	824.1	1.767	.98714	20.29887	.13611	820.9	1.760	.98331	20.22019	.15523	809.6	1.734	.96985	19.94343	.20957
30	180	2.000	.250	.5000	827.2	1.774	.99097	20.37755	.11394	822.5	1.763	.98523	20.25953	.14597	811.2	1.738	.97177	19.98277	.20268
31	180	2.200	.275	.5500	828.8	1.778	.99288	20.41689	.10109	824.1	1.767	.98714	20.29887	.13611	811.2	1.738	.97177	19.98277	.20268
32	180	2.400	.300	.6000	832.0	1.785	.99670	20.49556	.06868	825.7	1.771	.98905	20.33821	.12550	811.2	1.738	.97177	19.98277	.20268
33	180	2.630	.325	.6500	832.0	1.785	.99670	20.49556	.06868	827.2	1.774	.99097	20.37755	.11394	811.2	1.738	.97177	19.98277	.20268
34	180	2.800	.350	.7000	835.2	1.792	1.00053	20.57424	.00000	827.2	1.774	.99097	20.37755	.11394	808.0	1.731	.96794	19.90410	.21625
35	180	3.200	.375	.7500	835.2	1.792	1.00053	20.57424	.00000	827.2	1.774	.99097	20.37755	.11394	806.4	1.727	.96603	19.86476	.22275
36	180	3.200	.400	.8000	833.6	1.789	.99862	20.53490	.04445	824.1	1.767	.98714	20.29887	.13611	800.0	1.713	.95838	19.70742	.24719
37	180	3.400	.425	.8500	830.4	1.781	.99479	20.45622	.08640	819.3	1.756	.98140	20.18085	.16399	792.1	1.695	.94881	19.51074	.27501
38	180	3.600	.450	.9000	819.3	1.756	.98140	20.18085	.16399	804.9	1.724	.96418	19.82680	.22886	774.5	1.655	.92777	19.07804	.32902
39	180	3.300	.475	.9500	790.5	1.691	.94697	19.47275	.28010	772.9	1.652	.92592	19.04002	.33342	736.2	1.569	.88186	18.13397	.42763
40	270	1.000	.125	.2500	790.5	1.691	.94697	19.47275	.28010	798.5	1.709	.95653	19.66945	.25277	804.8	1.724	.96412	19.82542	.22908
41	270	2.000	.250	.5000	780.9	1.670	.93549	19.23672	.31013	798.5	1.709	.95653	19.66945	.25277	812.8	1.742	.97368	20.02211	.19557
42	270	3.000	.375	.7500	752.2	1.605	.90105	18.52862	.38870	782.5	1.673	.93740	19.27606	.30530	808.0	1.731	.96794	19.90410	.21625
43	90	1.000	.125	.2500	785.0	1.679	.94036	19.33686	.29770	777.0	1.661	.93078	19.13995	.32176	772.2	1.650	.92497	19.02048	.33566
44	90	2.000	.250	.5000	773.8	1.654	.92695	19.06118	.33098	757.8	1.618	.90780	18.66735	.37432	746.6	1.592	.89433	18.39040	.40264
45	90	3.000	.375	.7500	745.0	1.589	.89248	18.35229	.40642	717.9	1.527	.85992	17.68279	.46937	730.2	1.488	.83879	17.24838	.50749

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE XI.- DATA[a] FOR 180° CONE; $M_\infty = 3.95$ - Concluded

(e) $\alpha = 20°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 5765.1 psf					Φ = 90.0°, p_t = 5755.6 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	788.1	1.686	.94412	19.41427	.28779	786.5	1.685	.94376	19.40684	.28875
2	0	.200	.025	.0500	784.9	1.679	.94029	19.33551	.29787	786.5	1.685	.94376	19.40684	.28875
3	0	.400	.050	.1000	783.3	1.675	.93838	19.29613	.30281	788.1	1.689	.94568	19.44629	.28360
4	0	.600	.075	.1500	781.7	1.672	.93646	19.25675	.30768	786.5	1.685	.94376	19.40684	.28875
5	0	.800	.100	.2000	780.1	1.668	.93455	19.21738	.31249	786.5	1.685	.94376	19.40684	.28875
6	0	1.000	.125	.2500	778.6	1.664	.93263	19.17800	.31723	784.9	1.682	.94184	19.36740	.29383
7	0	1.200	.150	.3000	775.4	1.657	.92880	19.09924	.32655	783.3	1.678	.93992	19.32795	.29883
8	0	1.400	.175	.3500	772.2	1.650	.92497	19.02048	.33566	781.7	1.675	.93801	19.28851	.30376
9	0	1.600	.200	.4000	769.0	1.643	.92114	18.94172	.34458	780.1	1.671	.93609	19.24906	.30862
10	0	1.800	.225	.4500	765.8	1.636	.91731	18.86296	.35331	778.6	1.667	.93417	19.20962	.31343
11	0	2.000	.250	.5000	759.4	1.621	.90965	18.70544	.37030	775.4	1.660	.93033	19.13073	.32285
12	0	2.200	.275	.5500	754.6	1.610	.90391	18.58730	.38267	772.2	1.653	.92650	19.05184	.33206
13	0	2.400	.300	.6000	748.2	1.596	.89625	18.42978	.39870	767.4	1.642	.92074	18.93350	.34550
14	0	2.600	.325	.6500	740.2	1.578	.88667	18.23288	.41811	762.6	1.631	.91499	18.81517	.35853
15	0	2.800	.350	.7000	732.2	1.560	.87709	18.03598	.43692	756.2	1.617	.90731	18.65739	.37537
16	0	3.000	.375	.7500	719.4	1.531	.86177	17.72094	.46594	746.6	1.595	.89580	18.42072	.39961
17	0	3.200	.400	.8000	705.0	1.499	.84454	17.36652	.49729	733.8	1.566	.88046	18.10516	.43037
18	0	3.400	.425	.8500	687.4	1.459	.82347	16.93334	.53414	717.8	1.530	.86128	17.71071	.46686
19	0	3.600	.450	.9000	660.2	1.398	.79092	16.26389	.58870	692.2	1.472	.83059	17.07960	.52186
20	0	3.800	.475	.9500	613.9	1.293	.73538	15.12187	.67746	647.5	1.371	.77688	15.97514	.61156
21	180	.200	.025	.0500	795.3	1.702	.95264	19.58941	.26419	792.9	1.700	.95143	19.56462	.26764
22	180	.400	.050	.1000	795.3	1.702	.95264	19.58941	.26419	792.9	1.700	.95143	19.56462	.26764
23	180	.600	.075	.1500	795.3	1.702	.95264	19.58941	.26419	791.3	1.696	.94951	19.52518	.27305
24	180	.800	.100	.2000	796.8	1.706	.95455	19.62874	.25863	791.3	1.696	.94951	19.52518	.27305
25	180	1.000	.125	.2500	796.8	1.706	.95455	19.62874	.25863	789.7	1.693	.94760	19.48573	.27837
26	180	1.200	.150	.3000	796.8	1.706	.95455	19.62874	.25863	788.1	1.689	.94568	19.44629	.28360
27	180	1.400	.175	.3500	796.8	1.706	.95455	19.62874	.25863	786.5	1.685	.94376	19.40684	.28875
28	180	1.600	.200	.4000	796.8	1.706	.95455	19.62874	.25863	784.9	1.682	.94184	19.36740	.29383
29	180	1.800	.225	.4500	796.8	1.706	.95455	19.62874	.25863	781.7	1.675	.93801	19.28851	.30376
30	180	2.000	.250	.5000	795.3	1.702	.95264	19.58941	.26419	778.6	1.667	.93417	19.20962	.31343
31	180	2.200	.275	.5500	795.3	1.702	.95264	19.58941	.26419	775.4	1.660	.93033	19.13073	.32285
32	180	2.400	.300	.6000	792.1	1.695	.94881	19.51074	.27501	770.6	1.649	.92458	19.01239	.33659
33	180	2.600	.325	.6500	788.9	1.688	.94499	19.43206	.28547	765.8	1.638	.91882	18.89406	.34989
34	180	2.800	.350	.7000	784.1	1.677	.93925	19.31405	.30057	757.8	1.620	.90923	18.69683	.37121
35	180	3.000	.375	.7500	777.7	1.662	.93160	19.15671	.31977	748.2	1.599	.89772	18.46017	.39564
36	180	3.200	.400	.8000	768.1	1.641	.92012	18.92069	.34693	737.0	1.573	.88430	18.18405	.42283
37	180	3.400	.425	.8500	755.3	1.612	.90482	18.60600	.38073	721.0	1.537	.86511	17.78960	.45971
38	180	3.600	.450	.9000	733.0	1.562	.87803	18.05530	.43510	695.4	1.479	.83442	17.15849	.51517
39	180	3.800	.475	.9500	691.5	1.468	.82830	17.03256	.52582	655.7	1.378	.78071	16.05403	.60535
40	270	1.000	.125	.2500	808.0	1.731	.96794	19.90410	.21625	810.5	1.740	.97253	19.99851	.19986
41	270	2.000	.250	.5000	822.4	1.763	.98516	20.25812	.14631	824.9	1.772	.98980	20.35352	.12113
42	270	3.000	.375	.7500	828.8	1.778	.99281	20.41547	.10158	834.5	1.794	1.00131	20.59018	.00000
43	90	1.000	.125	.2500	769.0	1.643	.92114	18.96172	.34458	765.8	1.638	.91882	18.89406	.34989
44	90	2.000	.250	.5000	738.6	1.574	.88475	18.19350	.42192	737.0	1.573	.88430	18.18405	.42283
45	90	3.000	.375	.7500	690.6	1.466	.82730	17.01210	.52754	687.4	1.461	.82483	16.96126	.53181

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE XII.- DATA[a] FOR 180° CONE; $M_\infty = 4.63$

(a) $\alpha = 0°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 7871.9 psf					Φ = 22.5°, p_t = 7871.9 psf					Φ = 45.0°, p_t = 7871.9 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	636.3	1.764	.97890	27.47274	.17481	636.2	1.764	.97883	27.47083	.17510	636.2	1.764	.97883	27.47083	.17510
2	0	.230	.025	.0500	634.7	1.760	.97644	27.40371	.18487	634.6	1.759	.97637	27.40181	.18514	636.2	1.764	.97883	27.47083	.17510
3	0	.490	.050	.1000	636.3	1.764	.97890	27.47274	.17481	636.2	1.764	.97883	27.47083	.17510	636.2	1.764	.97883	27.47083	.17510
4	0	.630	.075	.1500	636.3	1.764	.97890	27.47274	.17481	636.2	1.764	.97883	27.47083	.17510	636.2	1.764	.97883	27.47083	.17510
5	0	.830	.100	.2000	636.3	1.764	.97890	27.47274	.17481	636.2	1.764	.97883	27.47083	.17510	636.2	1.764	.97883	27.47083	.17510
6	0	1.000	.125	.2500	634.7	1.760	.97644	27.40371	.18487	636.2	1.764	.97883	27.47083	.17510	636.2	1.764	.97883	27.47083	.17510
7	0	1.230	.150	.3000	633.1	1.755	.97398	27.33468	.19444	634.6	1.759	.97637	27.40181	.18514	636.2	1.764	.97883	27.47083	.17510
8	0	1.400	.175	.3500	633.1	1.755	.97398	27.33468	.19444	634.6	1.759	.97637	27.40181	.18514	634.6	1.759	.97637	27.40181	.18514
9	0	1.630	.200	.4000	631.5	1.750	.97152	27.26566	.20359	633.0	1.755	.97391	27.33278	.19470	633.0	1.755	.97391	27.33278	.19470
10	0	1.800	.225	.4500	629.9	1.746	.96906	27.19663	.21237	631.4	1.750	.97145	27.26376	.20383	631.4	1.750	.97145	27.26376	.20383
11	0	2.000	.250	.5000	628.3	1.741	.96660	27.12760	.22083	628.2	1.741	.96653	27.12572	.22105	628.2	1.741	.96653	27.12572	.22105
12	0	2.200	.275	.5500	625.1	1.732	.96168	26.98955	.23692	626.6	1.736	.96407	27.05669	.22922	626.6	1.736	.96407	27.05669	.22922
13	0	2.430	.300	.6000	621.9	1.723	.95676	26.85149	.25208	623.4	1.727	.95916	26.91865	.24481	621.8	1.723	.95670	26.84963	.25228
14	0	2.600	.325	.6500	617.1	1.709	.94938	26.64441	.27341	618.6	1.713	.95178	26.71158	.26666	617.0	1.709	.94932	26.64256	.27360
15	0	2.830	.350	.7000	610.7	1.691	.93955	26.36831	.29980	612.2	1.695	.94194	26.43550	.29357	610.6	1.690	.93948	26.36647	.29997
16	0	3.000	.375	.7500	602.7	1.668	.92725	26.02317	.33027	604.3	1.672	.92964	26.09038	.32452	604.3	1.672	.92964	26.09038	.32452
17	0	3.200	.400	.8000	593.1	1.640	.91249	25.60901	.36408	594.7	1.644	.91489	25.67625	.35876	593.1	1.640	.91243	25.60723	.36422
18	0	3.430	.425	.8500	583.3	1.603	.89281	25.05679	.40573	581.9	1.608	.89521	25.12407	.40083	580.3	1.603	.89275	25.05505	.40586
19	0	3.600	.450	.9000	559.5	1.543	.86084	24.15944	.46767	559.5	1.543	.86078	24.15776	.46778	559.5	1.543	.86078	24.15776	.46778
20	0	3.830	.475	.9500	521.2	1.433	.80181	22.50279	.57071	522.7	1.437	.80422	22.57025	.56671	521.1	1.433	.80176	22.50123	.57081
21	180	.230	.025	.0500	645.1	1.790	.99255	27.85595	.10339	645.1	1.790	.99248	27.85401	.10387	643.5	1.785	.99003	27.78507	.11974
22	180	.490	.050	.1000	643.5	1.785	.99010	27.78700	.11933	643.5	1.785	.99003	27.78507	.11974	643.5	1.785	.99003	27.78507	.11974
23	180	.630	.075	.1500	642.0	1.781	.98764	27.71805	.13341	641.9	1.780	.98757	27.71612	.13379	640.3	1.776	.98511	27.64718	.14653
24	180	.830	.100	.2000	642.0	1.781	.98764	27.71805	.13341	640.3	1.776	.98511	27.64718	.14653	640.3	1.776	.98511	27.64718	.14653
25	180	1.000	.125	.2500	640.4	1.776	.98518	27.64910	.14619	640.3	1.776	.98511	27.64718	.14653	638.7	1.771	.98266	27.57823	.15829
26	180	1.200	.150	.3000	640.4	1.776	.98518	27.64910	.14619	638.7	1.771	.98266	27.57823	.15829	637.1	1.767	.98020	27.50928	.16926
27	180	1.400	.175	.3500	638.8	1.771	.98273	27.58015	.15797	638.7	1.771	.98266	27.57823	.15829	635.5	1.762	.97774	27.44034	.17960
28	180	1.600	.200	.4000	638.8	1.771	.98273	27.58015	.15797	637.1	1.767	.98020	27.50928	.16926	633.9	1.757	.97529	27.37139	.18941
29	180	1.800	.225	.4500	635.6	1.762	.97781	27.44225	.17932	635.5	1.762	.97774	27.44034	.17960	632.3	1.753	.97283	27.30245	.19876
30	180	2.000	.250	.5000	634.0	1.758	.97536	27.37330	.18914	632.3	1.753	.97283	27.30245	.19876	630.7	1.748	.97037	27.23350	.20772
31	180	2.220	.275	.5500	632.4	1.753	.97290	27.30435	.19851	629.1	1.744	.96792	27.16456	.21633	627.5	1.739	.96546	27.09561	.22465
32	180	2.400	.300	.6000	629.2	1.744	.96799	27.16644	.21610	625.9	1.734	.96300	27.02667	.23269	624.3	1.730	.96055	26.95772	.24049
33	180	2.630	.325	.6500	624.4	1.730	.96061	26.95959	.24028	621.1	1.721	.95563	26.81983	.25544	619.6	1.716	.95318	26.75088	.26263
34	180	2.800	.350	.7000	618.0	1.712	.95079	26.68379	.26947	616.4	1.707	.94826	26.61299	.27653	614.8	1.702	.94581	26.54405	.28325
35	180	3.000	.375	.7500	611.6	1.693	.94096	26.40799	.29613	608.4	1.684	.93598	26.26826	.30889	606.8	1.679	.93352	26.19932	.31502
36	180	3.200	.400	.8000	602.0	1.666	.92622	25.99429	.33272	598.8	1.656	.92124	25.85459	.34435	597.2	1.652	.91878	25.78564	.34997
37	180	3.430	.425	.8500	587.7	1.624	.90411	25.37373	.38223	586.0	1.620	.90159	25.30303	.38757	584.4	1.615	.89913	25.23408	.39271
38	180	3.600	.450	.9000	566.9	1.565	.87217	24.47738	.44638	563.7	1.555	.86720	24.33779	.45581	563.7	1.555	.86720	24.33779	.45581
39	180	3.800	.475	.9500	530.2	1.459	.81566	22.89152	.54746	528.5	1.454	.81315	22.82099	.55172	526.9	1.450	.81069	22.75204	.55586
40	270	1.000	.125	.2500	640.4	1.776	.98518	27.64910	.14619	640.3	1.776	.98511	27.64718	.14653	640.3	1.776	.98511	27.64718	.14653
41	270	2.000	.250	.5000	633.8	1.748	.97044	27.23539	.20748	630.7	1.748	.97037	27.23350	.20772	632.3	1.753	.97283	27.30245	.19876
42	270	3.000	.375	.7500	603.6	1.670	.92868	26.06324	.32685	605.2	1.675	.93107	26.13037	.32106	638.4	1.684	.93598	26.26826	.30889
43	90	1.000	.125	.2500	633.1	1.755	.97398	27.33468	.19444	633.0	1.755	.97391	27.33278	.19470	633.0	1.755	.97391	27.33278	.19470
44	90	2.000	.250	.5000	623.5	1.727	.95922	26.92052	.24460	625.0	1.732	.96162	26.98767	.23713	625.0	1.732	.96162	26.98767	.23713
45	90	3.000	.375	.7500	599.5	1.658	.92233	25.88512	.34183	599.5	1.658	.92227	25.88332	.34198	601.1	1.663	.92472	25.95234	.33624

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE XII.- DATA[a] FOR 180° CONE; $M_\infty = 4.63$ - Continued

(a) $\alpha = 0°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 7871.9 psf					Φ = 90.0°, p_t = 7871.9 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	636.2	1.764	.97876	27.46892	.17539	635.3	1.761	.97739	27.43038	.18105
2	0	.200	.025	.0500	636.2	1.764	.97876	27.46892	.17539	635.3	1.761	.97739	27.43038	.18105
3	0	.400	.050	.1000	636.2	1.764	.97876	27.46892	.17539	635.3	1.761	.97739	27.43038	.18105
4	0	.600	.075	.1500	636.2	1.764	.97876	27.46892	.17539	635.3	1.761	.97739	27.43038	.18105
5	0	.800	.100	.2000	636.2	1.764	.97876	27.46892	.17539	635.3	1.761	.97739	27.43038	.18105
6	0	1.000	.125	.2500	636.2	1.764	.97876	27.46892	.17539	635.3	1.761	.97739	27.43038	.18105
7	0	1.200	.150	.3000	634.6	1.759	.97630	27.39990	.18541	633.7	1.757	.97493	27.36129	.19080
8	0	1.400	.175	.3500	633.0	1.755	.97384	27.33088	.19495	632.1	1.752	.97247	27.29219	.20011
9	0	1.600	.200	.4000	631.4	1.750	.97139	27.26187	.20408	628.9	1.743	.96754	27.15400	.21763
10	0	1.800	.225	.4500	628.2	1.741	.96647	27.12383	.22128	627.3	1.738	.96508	27.08491	.22591
11	0	2.000	.250	.5000	626.6	1.736	.96401	27.05481	.22944	624.1	1.729	.96016	26.96672	.24171
12	0	2.200	.275	.5500	623.4	1.727	.95909	26.91678	.24501	620.9	1.720	.95523	26.80853	.25663
13	0	2.400	.300	.6000	620.2	1.718	.95417	26.77874	.25975	616.1	1.706	.94785	26.60125	.27768
14	0	2.600	.325	.6500	613.8	1.700	.94433	26.50267	.28722	611.3	1.692	.94346	26.39397	.29743
15	0	2.800	.350	.7000	609.0	1.686	.93696	26.29562	.30643	604.9	1.674	.93061	26.11759	.32217
16	0	3.000	.375	.7500	601.0	1.663	.92466	25.95054	.33639	596.9	1.651	.91830	25.77212	.35107
17	0	3.200	.400	.8000	589.8	1.631	.90745	25.46741	.37508	587.3	1.623	.90353	25.35755	.38346
18	0	3.400	.425	.8500	577.0	1.594	.88777	24.91528	.41591	574.5	1.586	.88384	24.80480	.42374
19	0	3.600	.450	.9000	556.3	1.534	.85580	24.01805	.47694	553.7	1.527	.85183	23.90658	.48418
20	0	3.800	.475	.9500	519.5	1.428	.79924	22.43065	.57498	515.3	1.416	.79274	22.24832	.58570
21	180	.200	.025	.0500	644.2	1.787	.99106	27.81401	.11335	644.2	1.787	.99106	27.81401	.11335
22	180	.400	.050	.1000	642.6	1.782	.98860	27.74499	.12809	642.6	1.782	.98860	27.74499	.12809
23	180	.600	.075	.1500	641.0	1.778	.98614	27.67597	.14134	641.0	1.778	.98614	27.67597	.14134
24	180	.800	.100	.2000	639.4	1.773	.98368	27.60695	.15349	639.4	1.773	.98368	27.60695	.15349
25	180	1.000	.125	.2500	639.4	1.773	.98368	27.60695	.15349	639.4	1.773	.98368	27.60695	.15349
26	180	1.200	.150	.3000	637.8	1.769	.98122	27.53794	.16479	637.8	1.769	.98122	27.53794	.16479
27	180	1.400	.175	.3500	636.2	1.764	.97876	27.46892	.17539	636.2	1.764	.97876	27.46892	.17539
28	180	1.600	.200	.4000	634.6	1.759	.97630	27.39990	.18541	634.6	1.759	.97630	27.39990	.18541
29	180	1.800	.225	.4500	631.4	1.750	.97139	27.26187	.20408	631.4	1.750	.97139	27.26187	.20408
30	180	2.000	.250	.5000	629.8	1.746	.96893	27.19285	.21284	629.8	1.746	.96893	27.19285	.21284
31	180	2.200	.275	.5500	625.6	1.736	.96401	27.05481	.22944	625.0	1.732	.96155	26.98580	.23734
32	180	2.400	.300	.6000	623.4	1.727	.95909	26.91678	.24501	621.8	1.723	.95663	26.84776	.25248
33	180	2.600	.325	.6500	618.6	1.713	.95171	26.70973	.26685	617.0	1.709	.94925	26.64071	.27378
34	180	2.800	.350	.7000	612.2	1.695	.94187	26.43366	.29374	610.6	1.690	.93942	26.36464	.30014
35	180	3.000	.375	.7500	604.2	1.672	.92958	26.08857	.32468	602.6	1.667	.92712	26.01955	.33058
36	180	3.200	.400	.8000	594.6	1.644	.91482	25.67447	.35890	593.0	1.640	.91236	25.60545	.36435
37	180	3.400	.425	.8500	581.8	1.608	.89515	25.12233	.40095	578.6	1.598	.89023	24.98429	.41097
38	180	3.600	.450	.9000	559.5	1.543	.86072	24.15608	.46789	556.3	1.534	.85580	24.01805	.47694
39	180	3.800	.475	.9500	524.3	1.442	.80662	22.63770	.56270	521.1	1.433	.80170	22.49967	.57090
40	270	1.000	.125	.2500	641.0	1.778	.98614	27.67597	.14134	641.0	1.778	.98614	27.67597	.14134
41	270	2.000	.250	.5000	634.6	1.759	.97630	27.39990	.18541	634.6	1.759	.97630	27.39990	.18541
42	270	3.000	.375	.7500	612.2	1.695	.94187	26.43366	.29374	613.8	1.700	.94433	26.50267	.28722
43	90	1.000	.125	.2500	634.6	1.759	.97630	27.39990	.18541	635.3	1.761	.97739	27.43038	.18105
44	90	2.000	.250	.5000	626.6	1.736	.96401	27.05481	.22944	627.3	1.738	.96508	27.08491	.22591
45	90	3.000	.375	.7500	601.0	1.663	.92466	25.95054	.33639	603.3	1.669	.92815	26.04850	.32811

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE XII.- DATA[a] FOR 180° CONE; $M_\infty = 4.63$ - Continued

(b) $\alpha = 5°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 7871.9 psf					Φ = 22.5°, p_t = 7871.9 psf					Φ = 45.0°, p_t = 7871.9 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	636.3	1.764	.97890	27.47274	.17481	636.2	1.764	.97883	27.47083	.17510	636.2	1.764	.97883	27.47083	.17510
2	0	.200	.025	.0500	634.7	1.760	.97644	27.40371	.18487	634.6	1.759	.97637	27.40181	.18514	634.6	1.759	.97637	27.40181	.18514
3	0	.400	.050	.1000	634.7	1.760	.97644	27.40371	.18487	633.0	1.755	.97391	27.33278	.19470	634.6	1.759	.97637	27.40181	.18514
4	0	.600	.075	.1500	633.1	1.755	.97398	27.33468	.19444	633.0	1.755	.97391	27.33278	.19470	634.6	1.759	.97637	27.40181	.18514
5	0	.800	.100	.2000	633.1	1.755	.97398	27.33468	.19444	633.0	1.755	.97391	27.33278	.19470	634.6	1.759	.97637	27.40181	.18514
6	0	1.000	.125	.2500	631.5	1.750	.97152	27.26586	.20359	631.4	1.750	.97145	27.26376	.20383	633.0	1.755	.97391	27.33278	.19470
7	0	1.200	.150	.3000	628.3	1.741	.96660	27.12760	.22083	629.8	1.746	.96899	27.19476	.21260	631.4	1.750	.97145	27.26376	.20383
8	0	1.400	.175	.3500	626.7	1.737	.96414	27.05858	.22900	623.2	1.741	.96653	27.12572	.22105	628.2	1.741	.96653	27.12572	.22105
9	0	1.600	.200	.4000	623.5	1.727	.95922	26.92052	.24460	625.0	1.732	.96162	26.98767	.23713	625.6	1.736	.96407	27.05669	.22922
10	0	1.800	.225	.4500	620.3	1.718	.95430	26.78247	.25936	621.8	1.723	.95670	26.84963	.25228	625.0	1.732	.96162	26.98767	.23713
11	0	2.000	.250	.5000	617.1	1.709	.94938	26.64441	.27341	618.6	1.713	.95178	26.71158	.26666	620.2	1.718	.95424	26.78061	.25955
12	0	2.200	.275	.5500	612.3	1.695	.94201	26.43733	.29340	613.8	1.700	.94440	26.50452	.28704	617.0	1.709	.94932	26.64256	.27360
13	0	2.400	.300	.6000	607.5	1.681	.93463	26.23025	.31228	609.0	1.686	.93702	26.29745	.30626	612.2	1.695	.94194	26.43550	.29357
14	0	2.600	.325	.6500	601.1	1.663	.92479	25.95414	.33609	602.7	1.667	.92718	26.02136	.33042	605.9	1.677	.93210	26.15941	.31853
15	0	2.800	.350	.7000	593.1	1.640	.91249	25.60901	.36408	596.3	1.649	.91735	25.74527	.35323	599.5	1.658	.92227	25.88332	.34198
16	0	3.000	.375	.7500	585.1	1.617	.90019	25.26387	.39050	586.7	1.621	.90259	25.33114	.38545	589.9	1.631	.90751	25.46918	.37495
17	0	3.200	.400	.8000	573.9	1.585	.88298	24.78069	.42543	577.1	1.594	.88783	24.91701	.41579	578.7	1.598	.89029	24.98603	.41084
18	0	3.400	.425	.8500	557.9	1.539	.85838	24.09042	.47221	561.1	1.548	.86324	24.22679	.46321	564.3	1.557	.86816	24.36483	.45399
19	0	3.600	.450	.9000	537.2	1.479	.82641	23.19306	.52909	538.7	1.483	.82881	23.26047	.52494	541.9	1.493	.83373	23.39852	.51638
20	0	3.800	.475	.9500	500.4	1.373	.76984	21.60544	.62289	501.9	1.378	.77224	21.67296	.61903	505.1	1.387	.77716	21.81101	.61110
21	180	.200	.025	.0500	645.9	1.792	.99366	27.88690	.09539	643.5	1.785	.99003	27.78507	.11974	645.8	1.792	.99359	27.88496	.09591
22	180	.400	.050	.1000	645.9	1.792	.99366	27.88690	.09539	643.5	1.785	.99003	27.78507	.11974	644.2	1.787	.99113	27.81594	.11290
23	180	.600	.075	.1500	644.3	1.787	.99120	27.81787	.11246	643.5	1.785	.99003	27.78507	.11974	642.6	1.782	.98867	27.74692	.12770
24	180	.800	.100	.2000	644.3	1.787	.99120	27.81787	.11246	641.9	1.780	.98757	27.71612	.13379	642.6	1.782	.98867	27.74692	.12770
25	180	1.000	.125	.2500	644.3	1.787	.99120	27.81787	.11246	641.9	1.780	.98757	27.71612	.13379	641.0	1.778	.98621	27.67789	.14099
26	180	1.200	.150	.3000	642.7	1.783	.98874	27.74885	.12731	641.9	1.780	.98757	27.71612	.13379	639.4	1.773	.98375	27.60887	.15317
27	180	1.400	.175	.3500	642.7	1.783	.98874	27.74885	.12731	643.3	1.776	.98511	27.64718	.14653	639.4	1.773	.98375	27.60887	.15317
28	180	1.600	.200	.4000	642.7	1.783	.98874	27.74885	.12731	640.3	1.776	.98511	27.64718	.14653	637.8	1.769	.98129	27.53985	.16448
29	180	1.800	.225	.4500	641.1	1.778	.98628	27.67982	.14064	638.7	1.771	.98266	27.57823	.15829	636.2	1.764	.97883	27.47083	.17510
30	180	2.000	.250	.5000	639.5	1.773	.98382	27.61079	.15284	637.1	1.767	.98020	27.50928	.16926	634.6	1.759	.97637	27.40181	.18514
31	180	2.200	.275	.5500	637.9	1.769	.98136	27.54176	.16418	633.9	1.757	.97529	27.37139	.18941	633.0	1.755	.97391	27.33278	.19470
32	180	2.400	.300	.6000	634.7	1.760	.97644	27.40371	.18487	632.3	1.753	.97283	27.30245	.19876	629.8	1.746	.96899	27.19474	.21260
33	180	2.600	.325	.6500	633.1	1.755	.97398	27.33468	.19444	629.1	1.744	.96792	27.16456	.21633	625.0	1.732	.96162	26.98767	.23713
34	180	2.800	.350	.7000	628.3	1.741	.96660	27.12760	.22083	624.3	1.730	.96055	26.95772	.24049	620.2	1.718	.95424	26.78061	.25955
35	180	3.000	.375	.7500	623.5	1.727	.95922	26.92052	.24460	618.0	1.711	.95072	26.68194	.26966	613.8	1.700	.94440	26.50452	.28704
36	180	3.200	.400	.8000	615.5	1.704	.94692	26.57539	.28021	610.0	1.688	.93844	26.33721	.30265	605.9	1.677	.93210	26.15941	.31853
37	180	3.400	.425	.8500	602.7	1.668	.92725	26.02317	.33027	597.2	1.652	.91878	25.78564	.34997	593.1	1.640	.91243	25.60723	.36422
38	180	3.600	.450	.9000	583.5	1.612	.89773	25.19485	.39562	578.0	1.597	.88931	24.95830	.41284	572.3	1.580	.88046	24.70994	.43038
39	180	3.800	.475	.9500	549.9	1.516	.84608	23.74528	.49453	544.5	1.500	.83772	23.51044	.50939	538.7	1.483	.82881	23.26047	.52494
40	270	1.000	.125	.2500	641.1	1.778	.98628	27.67982	.14064	641.9	1.780	.98757	27.71612	.13379	642.6	1.782	.98867	27.74692	.12770
41	270	2.000	.250	.5000	633.1	1.755	.97398	27.33468	.19444	633.9	1.757	.97529	27.37139	.18941	637.8	1.769	.98129	27.53985	.16448
42	270	3.000	.375	.7500	607.5	1.681	.93463	26.23025	.31228	611.6	1.693	.94089	26.40615	.29630	617.0	1.709	.94932	26.64256	.27360
43	90	1.000	.125	.2500	633.1	1.755	.97398	27.33468	.19444	631.4	1.750	.97145	27.26376	.20383	631.4	1.750	.97145	27.26376	.20383
44	90	2.000	.250	.5000	623.5	1.727	.95922	26.92052	.24460	620.2	1.718	.95424	26.78061	.25955	620.2	1.718	.95424	26.78061	.25955
45	90	3.000	.375	.7500	597.9	1.654	.91987	25.81609	.34750	593.1	1.640	.91243	25.60723	.36422	589.9	1.631	.90751	25.46918	.37495

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE XII.- DATA[a] FOR 180° CONE; $M_\infty = 4.63$ - Continued

(b) $\alpha = 5°$ - Concluded

Orifice	e, deg	s, in.	s/D	s/s*	$\Phi = 67.5°$, $p_t = 7871.9$ psf					$\Phi = 90.0°$, $p_t = 7871.9$ psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	636.2	1.764	.97876	27.46892	.17539	636.2	1.764	.97876	27.46892	.17539
2	0	.200	.025	.0500	636.2	1.764	.97876	27.46892	.17539	636.2	1.764	.97876	27.46892	.17539
3	0	.400	.050	.1000	636.2	1.764	.97876	27.46892	.17539	636.2	1.764	.97876	27.46892	.17539
4	0	.600	.075	.1500	636.2	1.764	.97876	27.46892	.17539	636.2	1.764	.97876	27.46892	.17539
5	0	.800	.100	.2000	634.6	1.759	.97630	27.39990	.18541	634.6	1.759	.97630	27.39990	.18541
6	0	1.000	.125	.2500	634.6	1.759	.97630	27.39990	.18541	633.0	1.755	.97384	27.33088	.19495
7	0	1.200	.150	.3000	633.0	1.755	.97384	27.33088	.19495	631.4	1.750	.97139	27.26187	.20408
8	0	1.400	.175	.3500	631.4	1.750	.97139	27.26187	.20408	631.4	1.750	.97139	27.26187	.20408
9	0	1.600	.200	.4000	628.2	1.741	.96647	27.12383	.22128	628.2	1.741	.96647	27.12383	.22128
10	0	1.800	.225	.4500	625.6	1.736	.96401	27.05481	.22944	625.6	1.736	.96401	27.05481	.22944
11	0	2.000	.250	.5000	623.4	1.727	.95909	26.91678	.24501	623.4	1.727	.95909	26.91678	.24501
12	0	2.200	.275	.5500	620.2	1.718	.95417	26.77874	.25975	618.6	1.713	.95171	26.70973	.26685
13	0	2.400	.300	.6000	615.4	1.704	.94679	26.57169	.28057	613.8	1.700	.94433	26.50267	.28722
14	0	2.600	.325	.6500	610.6	1.690	.93942	26.36464	.30014	607.4	1.681	.93450	26.22661	.31261
15	0	2.800	.350	.7000	604.2	1.672	.92958	26.08857	.32468	599.4	1.658	.92220	25.88152	.34213
16	0	3.000	.375	.7500	594.6	1.644	.91482	25.67447	.35890	589.8	1.631	.90745	25.46741	.37508
17	0	3.200	.400	.8000	585.0	1.617	.90007	25.26036	.39076	577.0	1.594	.88777	24.91528	.41591
18	0	3.400	.425	.8500	570.6	1.575	.87794	24.63921	.43529	556.3	1.534	.85580	24.01805	.47694
19	0	3.600	.450	.9000	548.3	1.511	.84351	23.67296	.49913	517.5	1.428	.79924	22.43065	.57498
20	0	3.800	.475	.9500	511.5	1.405	.78694	22.08556	.59521	443.5	1.785	.98996	27.78314	.12016
21	180	.200	.025	.0500	644.2	1.787	.99106	27.81401	.11335	641.9	1.780	.98750	27.71419	.13416
22	180	.400	.050	.1000	644.2	1.787	.99106	27.81401	.11335	641.9	1.780	.98750	27.71419	.13416
23	180	.600	.075	.1500	641.0	1.778	.98614	27.67597	.14134	640.3	1.776	.98505	27.64525	.14687
24	180	.800	.100	.2000	641.0	1.778	.98614	27.67597	.14134	638.7	1.771	.98259	27.57631	.15860
25	180	1.000	.125	.2500	639.4	1.773	.98368	27.60695	.15349	637.1	1.766	.98013	27.50737	.16956
26	180	1.200	.150	.3000	639.4	1.773	.98368	27.60695	.15349	637.1	1.766	.98013	27.50737	.16956
27	180	1.400	.175	.3500	637.8	1.769	.98122	27.53794	.16479	635.5	1.762	.97768	27.43843	.17988
28	180	1.600	.200	.4000	636.2	1.764	.97876	27.46892	.17539	632.3	1.753	.97276	27.30055	.19901
29	180	1.800	.225	.4500	634.6	1.759	.97630	27.39990	.18541	629.1	1.744	.96785	27.16267	.21657
30	180	2.000	.250	.5000	631.4	1.750	.97139	27.26187	.20408	625.9	1.734	.96294	27.02479	.23290
31	180	2.200	.275	.5500	628.2	1.741	.96647	27.12383	.22128	621.1	1.721	.95557	26.81796	.25564
32	180	2.400	.300	.6000	625.0	1.732	.96155	26.98580	.23734	617.9	1.711	.95066	26.68008	.26984
33	180	2.600	.325	.6500	620.2	1.718	.95417	26.77874	.25975	611.5	1.693	.94083	26.40432	.29647
34	180	2.800	.350	.7000	615.4	1.704	.94679	26.57169	.28057	603.5	1.670	.92855	26.05962	.32716
35	180	3.000	.375	.7500	609.0	1.686	.93696	26.29562	.30643	594.0	1.642	.91381	25.64597	.36116
36	180	3.200	.400	.8000	599.4	1.658	.92220	25.88152	.34213	578.0	1.596	.88924	24.95656	.41296
37	180	3.400	.425	.8500	585.0	1.617	.90007	25.26036	.39076	557.2	1.537	.85731	24.06033	.47419
38	180	3.600	.450	.9000	564.3	1.557	.86810	24.36314	.45410	522.1	1.436	.80327	22.54364	.56829
39	180	3.800	.475	.9500	529.1	1.456	.81400	22.84475	.55029	643.5	1.785	.98996	27.78314	.12016
40	270	1.000	.125	.2500	644.2	1.787	.99136	27.81401	.11335	640.3	1.776	.98505	27.64525	.14687
41	270	2.000	.250	.5000	639.4	1.773	.98368	27.60695	.15349	624.3	1.730	.96048	26.95585	.24070
42	270	3.000	.375	.7500	620.2	1.718	.95417	26.77874	.25975	629.8	1.746	.96893	27.19285	.21284
43	90	1.000	.125	.2500	631.4	1.750	.97139	27.26187	.20408	617.0	1.709	.94925	26.64071	.27378
44	90	2.000	.250	.5000	617.0	1.709	.94925	26.64071	.27378	585.0	1.617	.90007	25.26036	.39076
45	90	3.000	.375	.7500	585.0	1.617	.90007	25.26036	.39076					

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE XII.- DATA[a] FOR 180° CONE; $M_\infty = 4.63$ - Continued

(c) $\alpha = 10°$

Orifice	e, deg	s, in.	s/D	s/s*	$\Phi = 0.0°$, $p_t = 7871.9$ psf					$\Phi = 22.5°$, $p_t = 7871.9$ psf					$\Phi = 45.0°$, $p_t = 7871.9$ psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	628.2	1.741	.96653	27.12572	.22105	628.2	1.741	.96653	27.12572	.22105	628.2	1.741	.96653	27.12572	.22105
2	0	.200	.025	.0500	626.6	1.736	.96407	27.05669	.22922	626.6	1.736	.96407	27.05669	.22922	626.6	1.736	.96407	27.05669	.22922
3	0	.400	.050	.1000	625.0	1.732	.96162	26.98767	.23713	625.0	1.732	.96162	26.98767	.23713	625.0	1.732	.96162	26.98767	.23713
4	0	.600	.075	.1500	623.4	1.727	.95916	26.91865	.24481	623.4	1.727	.95916	26.91865	.24481	623.4	1.727	.95916	26.91865	.24481
5	0	.800	.100	.2000	621.8	1.723	.95670	26.84963	.25228	621.8	1.723	.95670	26.84963	.25228	621.8	1.723	.95670	26.84963	.25228
6	0	1.000	.125	.2500	618.6	1.713	.95178	26.71158	.26666	618.6	1.713	.95178	26.71158	.26666	618.6	1.713	.95178	26.71158	.26666
7	0	1.200	.150	.3000	615.4	1.704	.94686	26.57354	.28039	615.4	1.704	.94686	26.57354	.28039	615.4	1.704	.94686	26.57354	.28039
8	0	1.400	.175	.3500	612.2	1.695	.94194	26.43550	.29357	612.2	1.695	.94194	26.43550	.29357	612.2	1.695	.94194	26.43550	.29357
9	0	1.600	.200	.4000	609.0	1.686	.93702	26.29745	.30626	609.0	1.686	.93702	26.29745	.30626	609.0	1.686	.93702	26.29745	.30626
10	0	1.800	.225	.4500	604.3	1.672	.92964	26.09038	.32452	605.9	1.677	.93210	26.15941	.31853	605.9	1.677	.93210	26.15941	.31853
11	0	2.000	.250	.5000	599.5	1.658	.92227	25.88332	.34198	601.1	1.663	.92472	25.95234	.33624	601.1	1.663	.92472	25.95234	.33624
12	0	2.200	.275	.5500	594.7	1.644	.91489	25.67625	.35876	596.3	1.649	.91735	25.74527	.35323	631.1	1.663	.92472	25.95234	.33624
13	0	2.400	.300	.6000	589.9	1.631	.90751	25.46918	.37495	589.9	1.631	.90751	25.46918	.37495	594.7	1.644	.91489	25.67625	.35876
14	0	2.600	.325	.6500	581.9	1.608	.89521	25.12407	.40083	583.5	1.612	.89767	25.19310	.39575	588.3	1.626	.90505	25.40016	.38023
15	0	2.800	.350	.7000	575.5	1.589	.88537	24.84798	.42069	575.5	1.589	.88537	24.84798	.42069	581.9	1.608	.89521	25.12407	.40083
16	0	3.000	.375	.7500	564.3	1.557	.86816	24.36483	.45399	565.9	1.562	.87062	24.43385	.44933	572.3	1.580	.88046	24.70994	.43038
17	0	3.200	.400	.8000	553.1	1.525	.85094	23.88167	.48578	553.1	1.525	.85094	23.88167	.48578	561.1	1.548	.86324	24.22679	.46321
18	0	3.400	.425	.8500	537.1	1.479	.82635	23.19145	.52919	537.1	1.479	.82635	23.19145	.52919	545.1	1.502	.83865	23.53656	.50775
19	0	3.500	.450	.9000	516.3	1.419	.79438	22.29416	.58302	515.3	1.419	.79438	22.29416	.58302	524.3	1.442	.80667	22.63928	.56260
20	0	3.800	.475	.9500	479.6	1.313	.73781	20.70665	.67365	479.6	1.313	.73781	20.70665	.67365	487.6	1.336	.75011	21.05177	.65430
21	180	.200	.025	.0500	639.4	1.773	.98375	27.60887	.15317	638.7	1.771	.98266	27.57823	.15829	637.8	1.769	.98129	27.53985	.16448
22	180	.400	.050	.1000	639.4	1.773	.98375	27.60887	.15317	638.7	1.771	.98266	27.57823	.15829	637.8	1.769	.98129	27.53985	.16448
23	180	.600	.075	.1500	639.4	1.773	.98375	27.60887	.15317	638.7	1.771	.98266	27.57823	.15829	637.8	1.769	.98129	27.53985	.16448
24	180	.800	.100	.2000	641.3	1.778	.98621	27.67789	.14099	640.3	1.776	.98511	27.64718	.14653	639.4	1.773	.98375	27.60887	.15317
25	180	1.000	.125	.2500	642.6	1.782	.98867	27.74692	.12770	640.3	1.776	.98511	27.64718	.14653	639.4	1.773	.98375	27.60887	.15317
26	180	1.200	.150	.3000	642.6	1.782	.98867	27.74692	.12770	640.3	1.776	.98511	27.64718	.14653	639.4	1.773	.98375	27.60887	.15317
27	180	1.400	.175	.3500	642.6	1.782	.98867	27.74692	.12770	641.9	1.780	.98757	27.71612	.13379	637.8	1.769	.98129	27.53985	.16448
28	180	1.600	.200	.4000	644.2	1.787	.99113	27.81594	.11290	641.9	1.780	.98757	27.71612	.13379	637.8	1.769	.98129	27.53985	.16448
29	180	1.800	.225	.4500	644.2	1.787	.99113	27.81594	.11290	641.9	1.780	.98757	27.71612	.13379	637.8	1.769	.98129	27.53985	.16448
30	180	2.000	.250	.5000	644.2	1.787	.99113	27.81594	.11290	640.3	1.776	.98511	27.64718	.14653	636.2	1.764	.97883	27.47083	.17510
31	180	2.200	.275	.5500	642.6	1.782	.98867	27.74692	.12770	640.3	1.776	.98511	27.64718	.14653	634.6	1.759	.97637	27.40181	.18514
32	180	2.400	.300	.6000	641.0	1.778	.98621	27.67789	.14099	638.7	1.771	.98266	27.57823	.15829	633.0	1.755	.97391	27.33278	.19470
33	180	2.600	.325	.6500	639.4	1.773	.98375	27.60887	.15317	635.5	1.762	.97774	27.44034	.17960	629.8	1.746	.96899	27.19474	.21260
34	180	2.800	.350	.7000	636.2	1.764	.97883	27.47083	.17510	633.9	1.757	.97529	27.37139	.18941	625.0	1.732	.96162	26.98767	.23713
35	180	3.000	.375	.7500	633.0	1.755	.97391	27.33278	.19470	629.1	1.744	.96792	27.18456	.21633	620.2	1.718	.95424	26.78061	.25955
36	180	3.200	.400	.8000	626.6	1.736	.96407	27.05669	.22922	622.7	1.725	.95809	26.88877	.24806	613.8	1.700	.94440	26.50452	.28704
37	180	3.400	.425	.8500	617.0	1.709	.94932	26.66256	.27360	611.6	1.693	.94089	26.40615	.29630	602.7	1.667	.92718	26.02136	.33042
38	180	3.600	.450	.9000	601.1	1.663	.92472	25.95234	.33624	594.0	1.643	.91387	25.64775	.36102	583.5	1.612	.89767	25.19310	.39575
39	180	3.800	.475	.9500	569.1	1.571	.87554	24.57190	.43993	562.1	1.551	.86474	24.26884	.46041	549.9	1.516	.84602	23.74363	.49464
40	270	1.200	.125	.2500	633.0	1.755	.97391	27.33278	.19470	635.5	1.762	.97774	27.44034	.17960	639.4	1.773	.98375	27.60887	.15317
41	270	2.000	.250	.5000	625.0	1.732	.96162	26.98767	.23713	632.3	1.753	.97283	27.30245	.19876	637.8	1.769	.98129	27.53985	.16448
42	270	3.000	.375	.7500	601.1	1.663	.92472	25.95234	.33624	613.2	1.698	.94335	26.47510	.28984	623.4	1.727	.95916	26.91865	.24481
43	90	1.200	.125	.2500	625.0	1.732	.96162	26.98767	.23713	621.8	1.723	.95670	26.84963	.25228	620.2	1.718	.95424	26.78061	.25955
44	90	2.000	.250	.5000	617.0	1.709	.94932	26.66256	.27360	609.0	1.686	.93702	26.29745	.30626	604.3	1.672	.92964	26.09038	.32452
45	90	3.000	.375	.7500	591.5	1.635	.90997	25.53821	.36961	580.3	1.603	.89275	25.05505	.40586	572.3	1.580	.88046	24.70994	.43038

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE XII.- DATA[a] FOR 180° CONE; $M_\infty = 4.63$ - Continued

(c) $\alpha = 10°$ - Concluded

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 7871.9 psf					Φ = 90.0°, p_t = 7871.9 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	628.2	1.741	.96647	27.12383	.22128	628.2	1.741	.96647	27.12383	.22128
2	0	.200	.025	.0500	628.2	1.741	.96647	27.12383	.22128	628.2	1.741	.96647	27.12383	.22128
3	0	.400	.050	.1000	626.6	1.736	.96401	27.05481	.22944	628.2	1.741	.96647	27.12383	.22128
4	0	.600	.075	.1500	625.0	1.732	.96155	26.98580	.23734	628.2	1.741	.96647	27.12383	.22128
5	0	.800	.100	.2000	625.0	1.732	.96155	26.98580	.23734	628.2	1.741	.96647	27.12383	.22128
6	0	1.000	.125	.2500	623.4	1.727	.95909	26.91678	.24501	626.6	1.736	.96401	27.05481	.22944
7	0	1.200	.150	.3000	621.8	1.723	.95663	26.84776	.25248	625.0	1.732	.96155	26.98580	.23734
8	0	1.400	.175	.3500	620.2	1.718	.95417	26.77874	.25975	623.4	1.727	.95909	26.91678	.24501
9	0	1.600	.200	.4000	617.0	1.709	.94925	26.64071	.27378	623.4	1.727	.95909	26.91678	.24501
10	0	1.800	.225	.4500	613.8	1.700	.94433	26.50267	.28722	620.2	1.718	.95417	26.77874	.25975
11	0	2.000	.250	.5000	610.6	1.690	.93942	26.36464	.30014	618.6	1.713	.95171	26.70973	.26685
12	0	2.200	.275	.5500	607.4	1.681	.93450	26.22661	.31261	615.4	1.704	.94679	26.57169	.28057
13	0	2.400	.300	.6000	602.6	1.667	.92712	26.01955	.33058	612.2	1.695	.94187	26.43366	.29374
14	0	2.600	.325	.6500	597.8	1.654	.91974	25.81250	.34779	607.4	1.681	.93450	26.22661	.31261
15	0	2.800	.350	.7000	591.4	1.635	.90991	25.53643	.36975	601.0	1.663	.92466	25.95054	.33639
16	0	3.000	.375	.7500	581.8	1.608	.89515	25.12233	.40095	593.0	1.640	.91236	25.60545	.36435
17	0	3.200	.400	.8000	572.2	1.580	.88039	24.70822	.43050	583.4	1.612	.89761	25.19134	.39588
18	0	3.400	.425	.8500	557.9	1.539	.85826	24.08707	.47243	573.6	1.575	.87794	24.63921	.43529
19	0	3.600	.450	.9000	537.1	1.479	.82629	23.18984	.52929	549.9	1.516	.84597	23.74198	.49474
20	0	3.800	.475	.9500	498.7	1.368	.76727	21.53342	.62701	513.1	1.410	.78940	22.15458	.59118
21	180	.200	.025	.0500	637.8	1.769	.98122	27.53794	.16479	636.2	1.764	.97876	27.46892	.17539
22	180	.400	.050	.1000	636.2	1.764	.97876	27.46892	.17539	636.2	1.764	.97876	27.46892	.17539
23	180	.600	.075	.1500	636.2	1.764	.97876	27.46892	.17539	634.6	1.759	.97630	27.39990	.18541
24	180	.800	.100	.2000	636.2	1.764	.97876	27.46892	.17539	633.0	1.755	.97384	27.33088	.19495
25	180	1.000	.125	.2500	636.2	1.764	.97876	27.46892	.17539	631.4	1.750	.97139	27.26187	.20408
26	180	1.200	.150	.3000	634.6	1.759	.97630	27.39990	.18541	631.4	1.750	.97139	27.26187	.20408
27	180	1.400	.175	.3500	634.6	1.759	.97630	27.39990	.18541	629.8	1.746	.96893	27.19285	.21284
28	180	1.600	.200	.4000	633.0	1.755	.97384	27.33088	.19495	626.6	1.736	.96401	27.05481	.22944
29	180	1.800	.225	.4500	631.4	1.750	.97139	27.26187	.20408	625.0	1.732	.96155	26.98580	.23734
30	180	2.000	.250	.5000	629.8	1.746	.96893	27.19285	.21284	621.8	1.723	.95663	26.84776	.25248
31	180	2.200	.275	.5500	626.6	1.736	.96401	27.05481	.22944	618.6	1.713	.95171	26.70973	.26685
32	180	2.400	.300	.6000	625.0	1.732	.96155	26.98580	.23734	615.4	1.704	.94679	26.57169	.28057
33	180	2.600	.325	.6500	620.2	1.718	.95417	26.77874	.25975	613.6	1.690	.93942	26.36464	.30014
34	180	2.800	.350	.7000	615.4	1.704	.94679	26.57169	.28057	604.2	1.672	.92958	26.08857	.32468
35	180	3.000	.375	.7500	609.0	1.686	.93696	26.29562	.30643	596.2	1.649	.91728	25.74348	.35338
36	180	3.200	.400	.8000	601.0	1.663	.92466	25.95054	.33639	586.6	1.621	.90253	25.32938	.38559
37	180	3.400	.425	.8500	588.2	1.626	.90499	25.39840	.38036	572.2	1.580	.88039	24.70822	.43050
38	180	3.600	.450	.9000	569.0	1.571	.87548	24.57019	.44004	551.5	1.520	.84843	23.81100	.49033
39	180	3.800	.475	.9500	533.9	1.470	.82137	23.05181	.53774	516.3	1.419	.79432	22.29261	.58311
40	270	1.000	.125	.2500	641.0	1.778	.98614	27.67597	.14134	641.0	1.778	.98614	27.67597	.14134
41	270	2.000	.250	.5000	642.6	1.782	.98860	27.74499	.12809	642.6	1.782	.98860	27.74499	.12809
42	270	3.000	.375	.7500	629.8	1.746	.96893	27.19285	.21284	633.0	1.755	.97384	27.33088	.19495
43	90	1.000	.125	.2500	618.6	1.713	.95171	26.70973	.26685	618.6	1.713	.95171	26.70973	.26685
44	90	2.000	.250	.5000	601.0	1.663	.92466	25.95054	.33639	601.0	1.663	.92466	25.95054	.33639
45	90	3.000	.375	.7500	565.8	1.562	.87056	24.43215	.44945	564.3	1.557	.86810	24.36314	.45410

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE XII.- DATA[a] FOR 180° CONE; $M_\infty = 4.63$ - Continued

(d) $\alpha = 15°$

Orifice	θ, deg	s, in.	s/D	s/s*	$\Phi = 0.0°$, $p_t = 7871.9$ psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	615.4	1.704	.94686	26.57354	.28039
2	0	.200	.025	.0500	612.2	1.695	.94194	26.43550	.29357
3	0	.400	.050	.1000	609.0	1.686	.93702	26.29745	.30626
4	0	.600	.075	.1500	607.5	1.681	.93456	26.22843	.31245
5	0	.800	.100	.2000	604.3	1.672	.92964	26.09038	.32452
6	0	1.000	.125	.2500	601.1	1.663	.92472	25.95234	.33624
7	0	1.200	.150	.3000	597.9	1.654	.91981	25.81430	.34764
8	0	1.400	.175	.3500	593.1	1.640	.91243	25.60723	.36422
9	0	1.600	.200	.4000	588.3	1.626	.90505	25.40016	.38023
10	0	1.800	.225	.4500	585.1	1.617	.90013	25.26212	.39063
11	0	2.000	.250	.5000	578.7	1.598	.89029	24.98603	.41084
12	0	2.200	.275	.5500	573.9	1.585	.88292	24.77896	.42555
13	0	2.400	.300	.6000	565.9	1.562	.87062	24.43385	.44933
14	0	2.600	.325	.6500	559.5	1.543	.86078	24.15776	.46778
15	0	2.800	.350	.7000	549.9	1.516	.84602	23.74363	.49464
16	0	3.000	.375	.7500	540.3	1.488	.83127	23.32950	.52067
17	0	3.200	.400	.8000	529.1	1.456	.81405	22.84634	.55019
18	0	3.400	.425	.8500	513.1	1.410	.78946	22.15612	.59109
19	0	3.600	.450	.9000	492.4	1.350	.75749	21.25883	.64261
20	0	3.800	.475	.9500	458.8	1.253	.70584	19.80937	.72338
21	180	.200	.025	.0500	625.9	1.734	.96300	27.02667	.23269
22	180	.400	.050	.1000	627.5	1.739	.96546	27.09561	.22465
23	180	.600	.075	.1500	629.1	1.744	.96792	27.16456	.21633
24	180	.800	.100	.2000	630.7	1.748	.97037	27.23350	.20772
25	180	1.000	.125	.2500	632.3	1.753	.97283	27.30245	.19876
26	180	1.200	.150	.3000	633.9	1.757	.97529	27.37139	.18941
27	180	1.400	.175	.3500	635.5	1.762	.97774	27.44034	.17960
28	180	1.600	.200	.4000	638.7	1.771	.98266	27.57823	.15829
29	180	1.800	.225	.4500	638.7	1.771	.98266	27.57823	.15829
30	180	2.000	.250	.5000	640.3	1.776	.98511	27.64718	.14653
31	180	2.200	.275	.5500	640.3	1.776	.98511	27.64718	.14653
32	180	2.400	.300	.6000	641.9	1.780	.98757	27.71612	.13379
33	180	2.600	.325	.6500	641.9	1.780	.98757	27.71612	.13379
34	180	2.800	.350	.7000	640.3	1.776	.98511	27.64718	.14653
35	180	3.000	.375	.7500	638.7	1.771	.98266	27.57823	.15829
36	180	3.200	.400	.8000	637.1	1.767	.98020	27.50928	.16926
37	180	3.400	.425	.8500	629.1	1.744	.96792	27.16456	.21633
38	180	3.600	.450	.9000	618.0	1.711	.95072	26.68194	.26966
39	180	3.800	.475	.9500	590.8	1.633	.90896	25.50986	.37181
40	270	1.000	.125	.2500	619.6	1.716	.95318	26.75088	.26263
41	270	2.000	.250	.5000	613.2	1.698	.94335	26.47510	.28984
42	270	3.000	.375	.7500	589.2	1.629	.90650	25.44092	.37712
43	90	1.000	.125	.2500	613.8	1.700	.94440	26.50452	.28704
44	90	2.000	.250	.5000	605.9	1.677	.93210	26.15941	.31853
45	90	3.000	.375	.7500	581.9	1.608	.89521	25.12407	.40083

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE XII.- DATA[a] FOR 180° CONE; $M_\infty = 4.63$ - Continued

(e) $\alpha = 20°$

Orifice	θ, deg	s, in.	s/D	s/s*	Φ = 0.0°, p_t = 7871.9 psf					Φ = 22.5°, p_t = 7871.9 psf					Φ = 45.0°, p_t = 7871.9 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	596.3	1.649	.91735	25.74527	.35323	596.3	1.649	.91735	25.74527	.35323	596.3	1.649	.91735	25.74527	.35323
2	0	.230	.025	.0500	591.5	1.635	.90997	25.53821	.36961	591.5	1.635	.90997	25.53821	.36961	593.1	1.640	.91243	25.60723	.36422
3	0	.430	.050	.1000	588.3	1.626	.90505	25.40016	.38023	589.9	1.631	.90751	25.46918	.37495	591.5	1.635	.90997	25.53821	.36961
4	0	.630	.075	.1500	586.7	1.621	.90259	25.33114	.38545	586.7	1.621	.90259	25.33114	.38545	589.9	1.631	.90751	25.46918	.37495
5	0	.800	.100	.2000	583.5	1.612	.89767	25.19310	.39575	583.5	1.612	.89767	25.19310	.39575	586.7	1.621	.90259	25.33114	.38545
6	0	1.030	.125	.2500	578.7	1.598	.89029	24.98603	.41084	580.3	1.603	.89275	25.05505	.40586	583.5	1.612	.89767	25.19310	.39575
7	0	1.230	.150	.3000	575.5	1.589	.88537	24.84798	.42069	577.1	1.594	.88783	24.91701	.41579	580.3	1.603	.89275	25.05505	.40586
8	0	1.400	.175	.3500	570.7	1.575	.87800	24.64592	.43517	572.3	1.580	.88046	24.70994	.43038	577.1	1.594	.88783	24.91701	.41579
9	0	1.600	.200	.4000	565.9	1.562	.87062	24.43385	.44933	569.1	1.571	.87554	24.57190	.43993	573.9	1.585	.88292	24.77896	.42555
10	0	1.800	.225	.4500	561.1	1.548	.86324	24.22679	.46321	564.3	1.557	.86816	24.36483	.45399	569.1	1.571	.87554	24.57190	.43993
11	0	2.000	.250	.5000	556.3	1.534	.85586	24.01972	.47683	559.5	1.543	.86078	24.15776	.46778	565.9	1.562	.87062	24.43385	.44933
12	0	2.200	.275	.5500	549.9	1.516	.84602	23.74363	.49464	553.1	1.525	.85094	23.88167	.48578	561.1	1.548	.86324	24.22679	.46321
13	0	2.400	.300	.6000	543.5	1.497	.83619	23.46754	.51207	546.7	1.506	.84111	23.60559	.50340	554.7	1.529	.85340	23.95070	.48132
14	0	2.600	.325	.6500	537.1	1.479	.82635	23.19145	.52919	540.3	1.488	.83127	23.32950	.52067	548.3	1.511	.84357	23.67461	.49903
15	0	2.800	.350	.7000	529.1	1.456	.81405	22.84634	.55019	532.3	1.465	.81897	22.98439	.54184	540.3	1.488	.83127	23.32950	.52067
16	0	3.030	.375	.7500	519.5	1.428	.79930	22.43221	.57489	521.1	1.433	.80176	22.50123	.57081	530.7	1.460	.81651	22.91536	.54602
17	0	3.200	.400	.8000	508.3	1.396	.78208	21.94905	.60313	511.5	1.405	.78700	22.08710	.59512	519.5	1.428	.79930	22.43221	.57489
18	0	3.400	.425	.8500	494.0	1.355	.75995	21.32785	.63870	497.2	1.364	.76687	21.46590	.63086	505.1	1.387	.77716	21.81101	.61110
19	0	3.600	.450	.9000	473.2	1.295	.72797	20.43057	.68903	476.4	1.304	.73289	20.56861	.68139	484.4	1.327	.74519	20.91372	.66206
20	0	3.830	.475	.9500	441.2	1.203	.67879	19.05012	.76505	444.4	1.212	.68371	19.18817	.75749	452.4	1.235	.69600	19.53328	.73856
21	180	.200	.025	.0500	606.8	1.679	.93352	26.19932	.31502	607.5	1.681	.93456	26.22843	.31245	605.9	1.677	.93210	26.15941	.31853
22	180	.400	.050	.1000	610.0	1.688	.93844	26.33721	.30265	609.0	1.686	.93702	26.29745	.30626	607.5	1.681	.93456	26.22843	.31245
23	180	.600	.075	.1500	611.6	1.693	.94089	26.40615	.29630	612.2	1.695	.94194	26.43550	.29357	609.0	1.686	.93702	26.29745	.30626
24	180	.800	.100	.2000	614.8	1.702	.94581	26.54405	.28325	613.8	1.700	.94440	26.50452	.28704	610.6	1.690	.93948	26.36647	.29997
25	180	1.000	.125	.2500	618.0	1.711	.95072	26.68194	.26966	617.0	1.709	.94932	26.64256	.27360	612.2	1.695	.94194	26.43550	.29357
26	180	1.230	.150	.3000	621.1	1.721	.95563	26.81983	.25544	620.2	1.718	.95424	26.78061	.25955	615.4	1.704	.94686	26.57354	.28039
27	180	1.430	.175	.3500	624.3	1.730	.96055	26.95772	.24049	621.8	1.723	.95670	26.84963	.25228	615.4	1.704	.94686	26.57354	.28039
28	180	1.600	.200	.4000	627.5	1.739	.96546	27.09561	.22465	625.0	1.732	.96162	26.98767	.23713	617.0	1.709	.94932	26.64256	.27360
29	180	1.800	.225	.4500	630.7	1.748	.97037	27.23350	.20772	628.2	1.741	.96653	27.12572	.22105	618.6	1.713	.95178	26.71158	.26666
30	180	2.000	.250	.5000	632.3	1.753	.97283	27.30245	.19876	629.8	1.746	.96899	27.19474	.21260	620.2	1.718	.95424	26.78061	.25955
31	180	2.200	.275	.5500	635.5	1.762	.97774	27.44034	.17960	631.4	1.750	.97145	27.26376	.20383	620.2	1.718	.95424	26.78061	.25955
32	180	2.430	.300	.6000	638.7	1.771	.98266	27.57823	.15829	634.6	1.759	.97637	27.40181	.18514	621.8	1.723	.95670	26.84963	.25228
33	180	2.600	.325	.6500	640.3	1.776	.98511	27.64718	.14653	636.2	1.764	.97883	27.47083	.17510	621.8	1.723	.95670	26.84963	.25228
34	180	2.300	.350	.7000	641.9	1.780	.98757	27.71612	.13379	637.8	1.769	.98129	27.53985	.16448	621.8	1.723	.95670	26.84963	.25228
35	180	3.000	.375	.7500	643.5	1.785	.99003	27.78507	.11974	639.4	1.773	.98375	27.60887	.15317	620.2	1.718	.95424	26.78061	.25955
36	180	3.230	.400	.8000	645.1	1.790	.99248	27.85401	.10387	637.8	1.769	.98129	27.53985	.16448	617.0	1.709	.94932	26.64256	.27360
37	180	3.400	.425	.8500	643.5	1.785	.99003	27.78507	.11974	636.6	1.759	.97637	27.40181	.18514	610.6	1.690	.93948	26.36647	.29997
38	180	3.600	.450	.9000	635.5	1.762	.97774	27.44034	.17960	625.0	1.732	.96162	26.98767	.23713	599.5	1.658	.92227	25.88332	.34198
39	180	3.830	.475	.9500	614.8	1.702	.94581	26.54405	.28325	604.3	1.672	.92964	26.09038	.32452	578.7	1.595	.87800	24.64092	.43517
40	270	1.000	.125	.2500	600.4	1.661	.92370	25.92354	.33865	607.5	1.681	.93456	26.22843	.31245	612.2	1.695	.94194	26.43550	.29357
41	270	2.000	.250	.5000	592.4	1.638	.91142	25.57881	.36644	607.5	1.681	.93456	26.22843	.31245	620.2	1.718	.95424	26.78061	.25955
42	270	3.000	.375	.7500	571.6	1.578	.87948	24.68252	.43229	594.7	1.644	.91489	25.67625	.35876	618.6	1.713	.95178	26.71158	.26666
43	90	1.000	.125	.2500	593.1	1.640	.91243	25.60723	.36422	588.3	1.626	.90505	25.40016	.38023	583.5	1.612	.89767	25.19310	.39575
44	90	2.000	.250	.5000	588.3	1.626	.90505	25.40016	.38023	573.9	1.585	.88292	24.77896	.42555	564.3	1.557	.86816	24.36483	.45399
45	90	3.000	.375	.7500	565.9	1.562	.87062	24.43385	.44933	545.1	1.502	.83865	23.53656	.50775	532.3	1.465	.81897	22.98439	.54184

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

TABLE XII.- DATA[a] FOR 180° CONE; M_∞ = 4.63 - Concluded

(e) α = 20° - Concluded

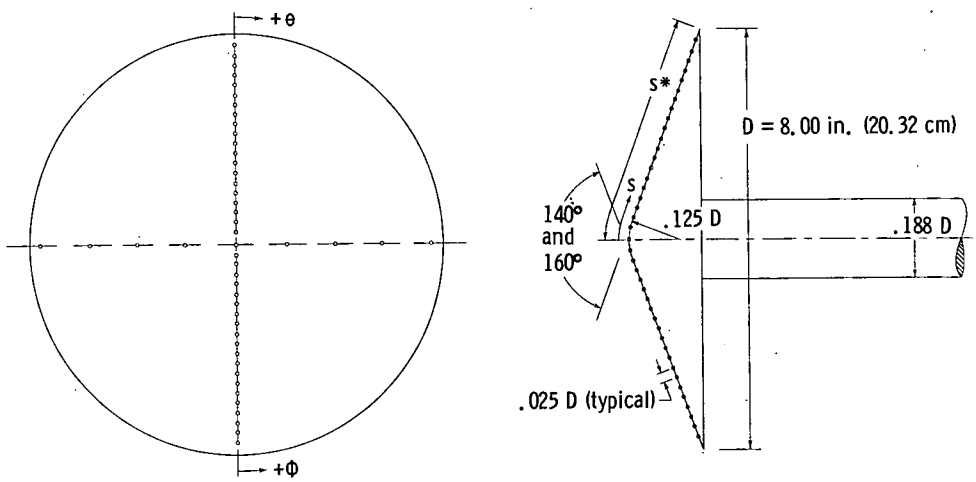
Orifice	e, deg	s, in.	s/D	s/s*	Φ = 67.5°, p_t = 7871.9 psf					Φ = 90.0°, p_t = 7871.9 psf				
					p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l	p_l, psf	C_p	$p_l/p_{t,2}$	p_l/p_∞	M_l
1	0	.000	.000	.0000	596.2	1.649	.91728	25.74348	.35338	596.2	1.649	.91728	25.74348	.35338
2	0	.200	.025	.0500	594.6	1.644	.91482	25.67447	.35890	596.2	1.649	.91728	25.74348	.35338
3	0	.400	.050	.1000	593.0	1.640	.91236	25.60545	.36435	594.6	1.644	.91482	25.67447	.35890
4	0	.600	.075	.1500	591.4	1.635	.90991	25.53643	.36975	596.2	1.649	.91728	25.74348	.35338
5	0	.800	.100	.2000	589.8	1.631	.90745	25.46741	.37508	594.6	1.644	.91482	25.67447	.35890
6	0	1.000	.125	.2500	588.2	1.626	.90499	25.39840	.38036	594.6	1.644	.91482	25.67447	.35890
7	0	1.200	.150	.3000	586.6	1.621	.90253	25.32938	.38559	593.0	1.640	.91236	25.60545	.36435
8	0	1.400	.175	.3500	585.0	1.617	.90007	25.26036	.39076	591.4	1.635	.90991	25.53643	.36975
9	0	1.600	.200	.4000	581.8	1.608	.89515	25.12233	.40095	589.8	1.631	.90745	25.46741	.37508
10	0	1.800	.225	.4500	578.6	1.598	.89023	24.98429	.41097	588.2	1.626	.90499	25.39840	.38036
11	0	2.000	.250	.5000	575.4	1.589	.88531	24.84626	.42081	586.6	1.621	.90253	25.32938	.38559
12	0	2.200	.275	.5500	570.6	1.575	.87794	24.63921	.43529	583.4	1.612	.89761	25.19134	.39588
13	0	2.400	.300	.6000	565.8	1.562	.87056	24.43215	.44945	580.2	1.603	.89269	25.05331	.40598
14	0	2.600	.325	.6500	561.1	1.548	.86318	24.22510	.46332	577.0	1.594	.88777	24.91528	.41591
15	0	2.800	.350	.7000	553.1	1.525	.85088	23.88001	.48589	572.2	1.580	.88039	24.70822	.43050
16	0	3.000	.375	.7500	543.5	1.497	.83613	23.46591	.51218	564.3	1.557	.86810	24.36314	.45410
17	0	3.200	.400	.8000	533.9	1.470	.82137	23.05181	.53774	556.3	1.534	.85580	24.01805	.47694
18	0	3.400	.425	.8500	521.1	1.433	.80170	22.49967	.57090	543.5	1.497	.83613	23.46591	.51218
19	0	3.600	.450	.9000	500.3	1.373	.76973	21.60244	.62307	524.3	1.442	.80662	22.63770	.56270
20	0	3.800	.475	.9500	466.7	1.276	.71809	20.15308	.70441	492.3	1.350	.75743	21.25735	.64270
21	180	.200	.025	.0500	605.1	1.675	.93100	26.12856	.32122	604.2	1.672	.92958	26.08857	.32468
22	180	.400	.050	.1000	605.1	1.675	.93100	26.12856	.32122	602.6	1.667	.92712	26.01955	.33058
23	180	.600	.075	.1500	605.1	1.675	.93130	26.12856	.32122	601.0	1.663	.92466	25.95054	.33639
24	180	.800	.100	.2000	605.1	1.675	.93100	26.12856	.32122	631.0	1.663	.92466	25.95054	.33639
25	180	1.000	.125	.2500	606.7	1.679	.93346	26.19750	.31518	601.0	1.663	.92466	25.95054	.33639
26	180	1.200	.150	.3000	606.7	1.679	.93346	26.19750	.31518	599.4	1.658	.92220	25.88152	.34213
27	180	1.400	.175	.3500	606.7	1.679	.93346	26.19750	.31518	597.8	1.654	.91974	25.81250	.34779
28	180	1.600	.200	.4000	636.7	1.679	.93346	26.19750	.31518	596.2	1.649	.91728	25.74348	.35338
29	180	1.800	.225	.4500	606.7	1.679	.93346	26.19750	.31518	596.2	1.649	.91728	25.74348	.35338
30	180	2.000	.250	.5000	606.7	1.679	.93346	26.19750	.31518	593.0	1.640	.91236	25.60545	.36435
31	180	2.200	.275	.5500	606.7	1.679	.93346	26.19750	.31518	591.4	1.635	.90991	25.53643	.36975
32	180	2.400	.300	.6000	605.1	1.675	.93100	26.12856	.32122	588.2	1.626	.90499	25.39840	.38036
33	180	2.600	.325	.6500	601.9	1.665	.92609	25.99067	.33302	583.4	1.612	.89761	25.19134	.39588
34	180	2.800	.350	.7000	598.8	1.656	.92118	25.85279	.34449	577.0	1.594	.88777	24.91528	.41591
35	180	3.000	.375	.7500	594.0	1.642	.91381	25.64597	.36116	570.6	1.575	.87794	24.63921	.43529
36	180	3.200	.400	.8000	587.6	1.624	.90398	25.37021	.38250	562.7	1.552	.86564	24.29412	.45873
37	180	3.400	.425	.8500	578.0	1.596	.88924	24.95656	.41296	549.9	1.516	.84597	23.74198	.49474
38	180	3.600	.450	.9000	560.4	1.546	.86222	24.19821	.46511	529.1	1.456	.81400	22.84475	.55029
39	180	3.800	.475	.9500	528.5	1.454	.81309	22.81940	.55181	497.1	1.364	.76481	21.46441	.63096
40	270	1.000	.125	.2500	616.3	1.707	.94820	26.61114	.27671	617.0	1.709	.94925	26.64071	.27378
41	270	2.000	.250	.5000	629.1	1.744	.96785	27.16267	.21657	633.0	1.755	.97384	27.33088	.19495
42	270	3.000	.375	.7500	638.7	1.771	.98259	27.57631	.15860	644.2	1.787	.99106	27.81401	.11335
43	90	1.000	.125	.2500	580.2	1.603	.89269	25.05331	.40598	578.6	1.598	.89023	24.98429	.41097
44	90	2.000	.250	.5000	557.9	1.539	.85826	24.08707	.47243	556.3	1.534	.85580	24.01805	.47694
45	90	3.000	.375	.7500	521.1	1.433	.80170	22.49967	.57090	519.5	1.428	.79924	22.43065	.57498

[a]Conversion factors: 1 inch = 2.54 cm; 1 psf = 47.88 N/m^2.

Orifice number	θ, deg	s/D	s/s*	
			140° cone	160° cone
1	0	0.000	0.0000	.0000
2	↓	.025	.0471	.0493
3		.050	.0943	.0985
4		.075	.1414	.1478
5		.100	.1886	.1971
6		.125	.2357	.2463
7		.150	.2829	.2956
8		.175	.3300	.3448
9		.200	.3772	.3941
10		.225	.4243	.4434
11		.250	.4715	.4926
12		.275	.5186	.5419
13		.300	.5658	.5912
14		.325	.6129	.6404
15		.350	.6601	.6897
16		.375	.7072	.7389
17		.400	.7544	.7882
18		.425	.8015	.8375
19		.450	.8487	.8867
20		.475	.8958	.9360
21	↓	.500	.9430	.9852
22	180	.025	.0471	.0493
23	↓	.050	.0943	.0985
24		.075	.1414	.1478
25		.100	.1886	.1971

Orifice number	θ, deg	s/D	s/s*	
			140° cone	160° cone
26	180	0.125	0.2357	0.2463
27	↓	.150	.2829	.2956
28		.175	.3300	.3448
29		.200	[a].3772	.3941
30		.225	.4243	.4434
31		.250	.4715	.4926
32		.275	.5186	.5419
33		.300	.5658	.5912
34		.325	.6129	.6404
35		.350	.6601	.6897
36		.375	.7072	.7389
37		.400	.7544	.7882
38		.425	.8015	.8375
39		.450	.8487	.8867
40		.475	.8958	.9360
41	↓	.500	.9430	.9852
42	270	.125	.2357	.2463
43	↓	.250	.4715	.4926
44		.375	.7072	.7389
45	↓	.500	.9430	.9852
46	90	.125	.2357	.2463
47	↓	.250	.4715	.4926
48		.375	.7072	.7389
49	↓	.500	.9430	.9852

[a]Data for orifice 29 on the 140° cone were inaccurate due to leakage.

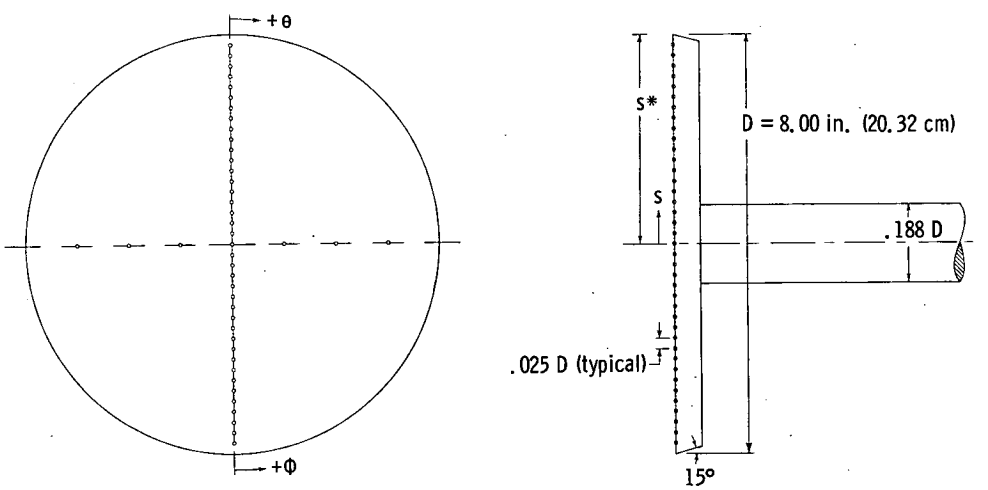


(a) 140° and 160° cones.

Figure 1.- Model details and pressure-orifice locations. (Dimensions are presented as fractions of base diameter D and total surface length s*.)

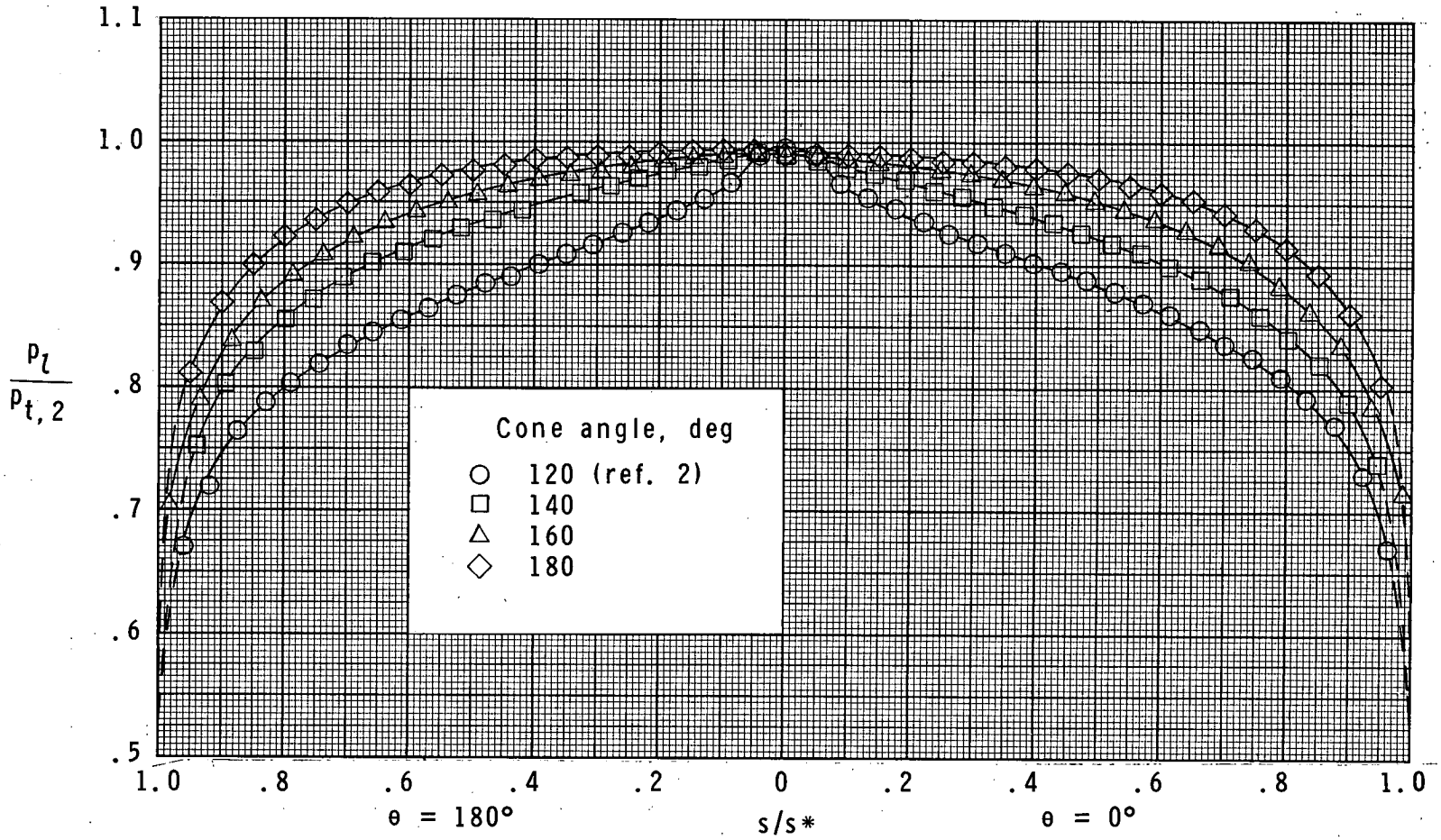
Orifice number	θ, deg	s/D	s/s*
1	0	.000	0.0000
2		.025	.0500
3		.050	.1000
4		.075	.1500
5		.100	.2000
6		.125	.2500
7		.150	.3000
8		.175	.3500
9		.200	.4000
10		.225	.4500
11		.250	.5000
12		.275	.5500
13		.300	.6000
14		.325	.6500
15		.350	.7000
16		.375	.7500
17		.400	.8000
18		.425	.8500
19		.450	.9000
20		.475	.9500
21	180	.025	.0500
22		.050	.1000
23		.075	.1500

Orifice number	θ, deg	s/D	s/s*
24	180	0.100	0.2000
25		.125	.2500
26		.150	.3000
27		.175	.3500
28		.200	.4000
29		.225	.4500
30		.250	.5000
31		.275	.5500
32		.300	.6000
33		.325	.6500
34		.350	.7000
35		.375	.7500
36		.400	.8000
37		.425	.8500
38		.450	.9000
39		.475	.9500
40	270	.125	.2500
41		.250	.5000
42		.375	.7500
43	90	.125	.2500
44		.250	.5000
45		.375	.7500



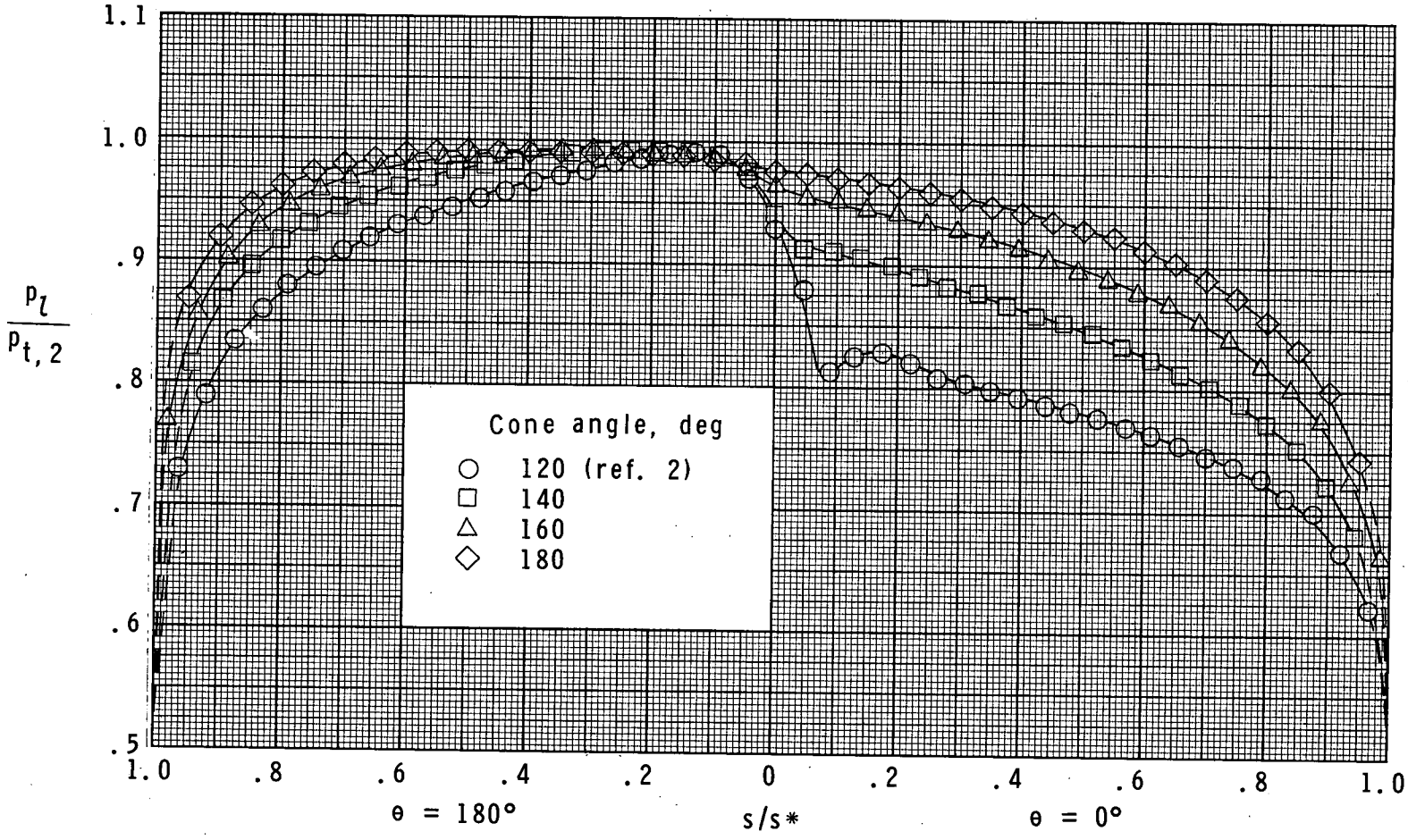
(b) 180° cone (flat disk).

Figure 1.- Concluded.



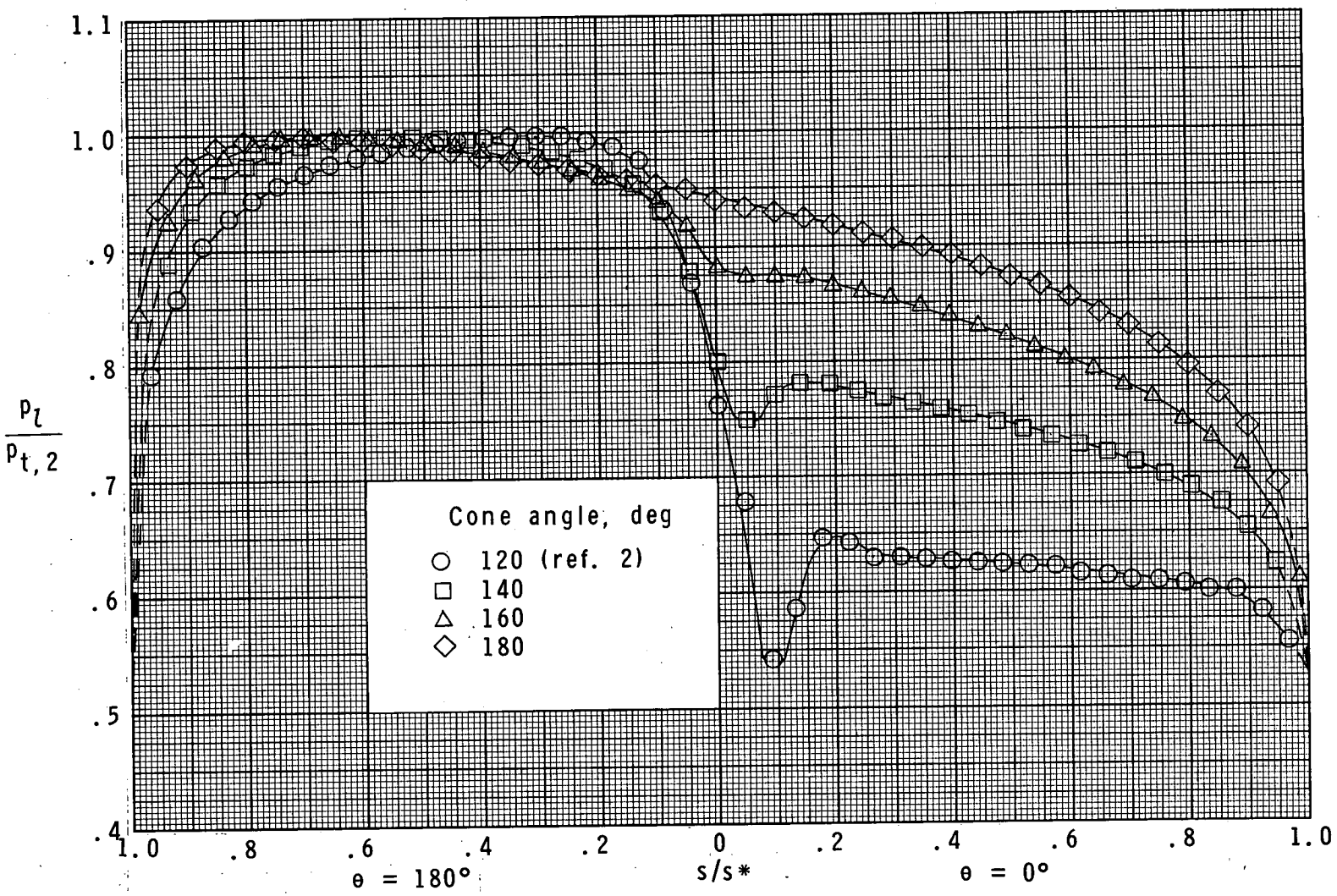
(a) $\alpha = 0^0$.

Figure 2.- Effect of cone angle on pressure distributions for $M_\infty = 2.96$. $\Phi = 0.0^0$.



(b) $\alpha = 10^0$.

Figure 2.- Continued.



(c) $\alpha = 20^{0}$.

Figure 2.- Concluded.

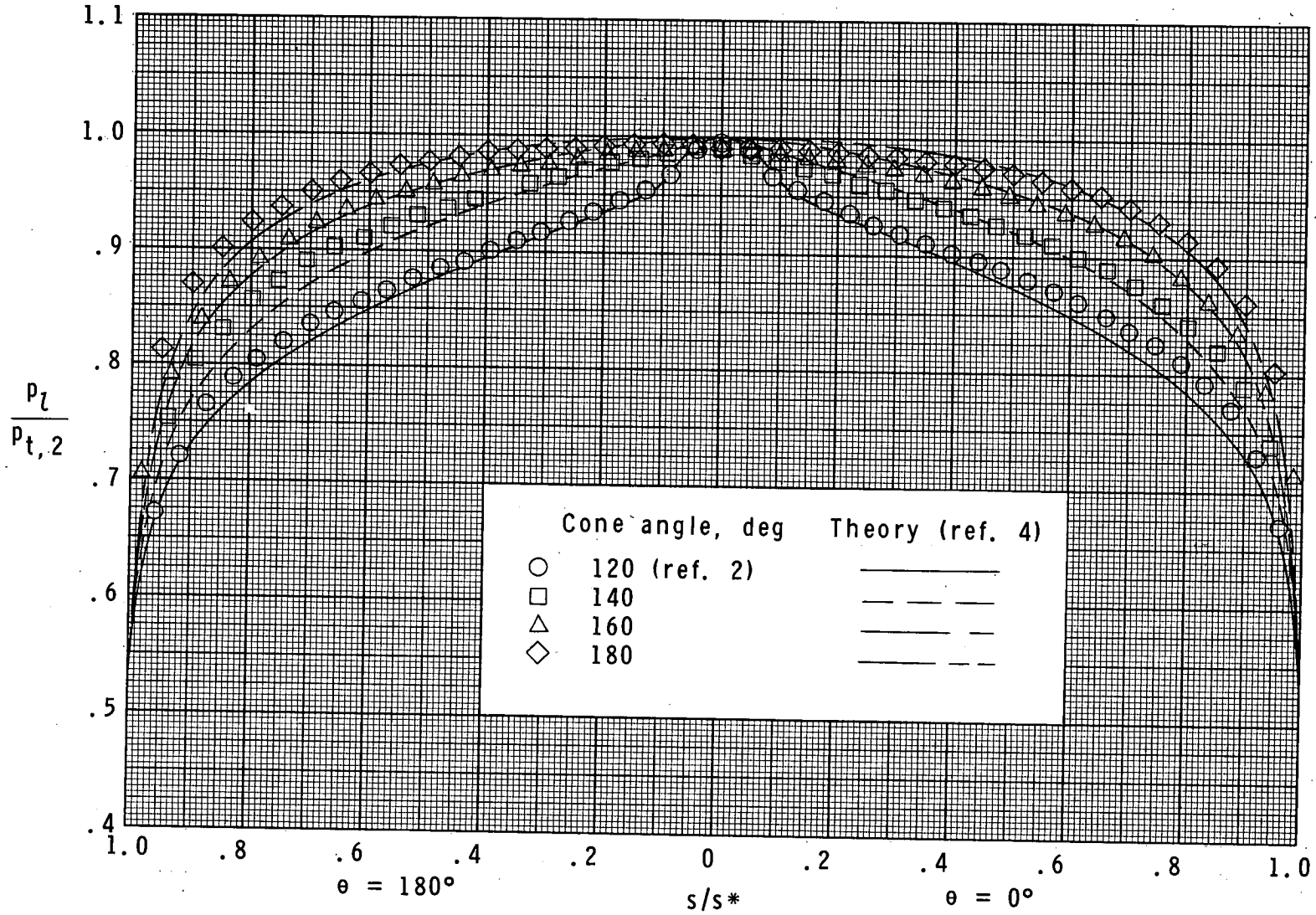
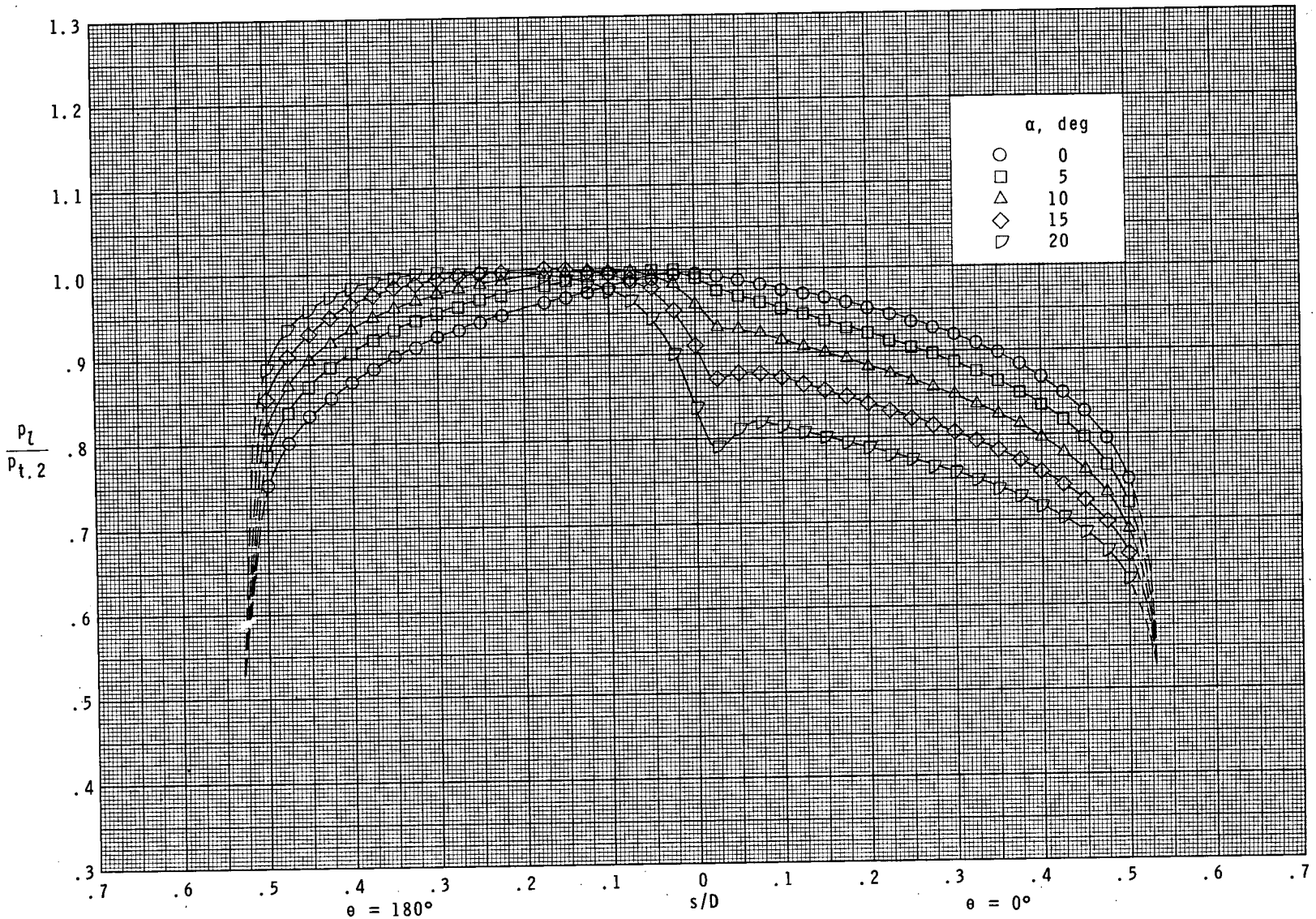
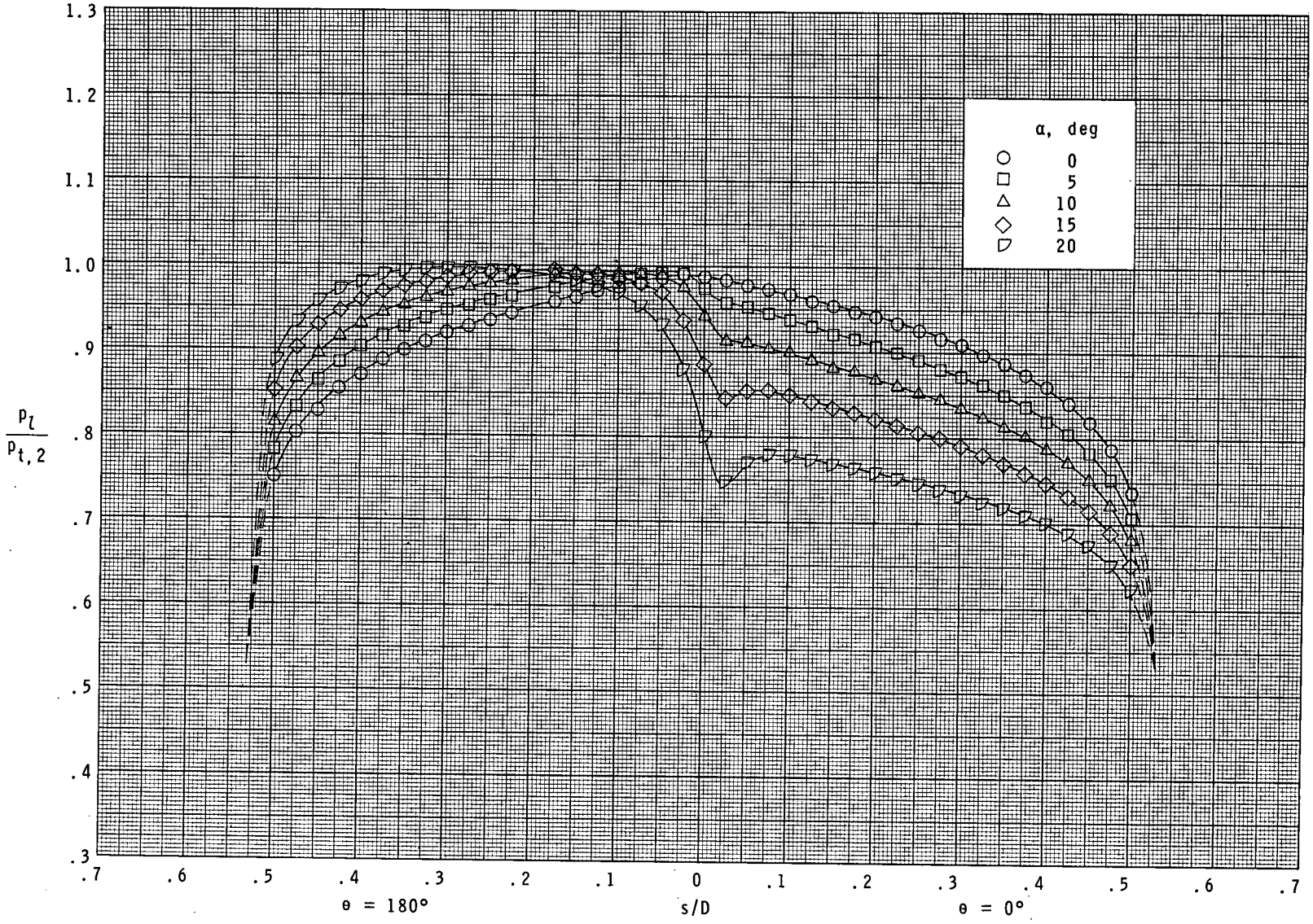


Figure 3.- Comparison of experimental and theoretical pressure distributions for cone models at $\alpha = 0^0$ and $M_\infty = 2.96$. $\Phi = 0.0^0$.



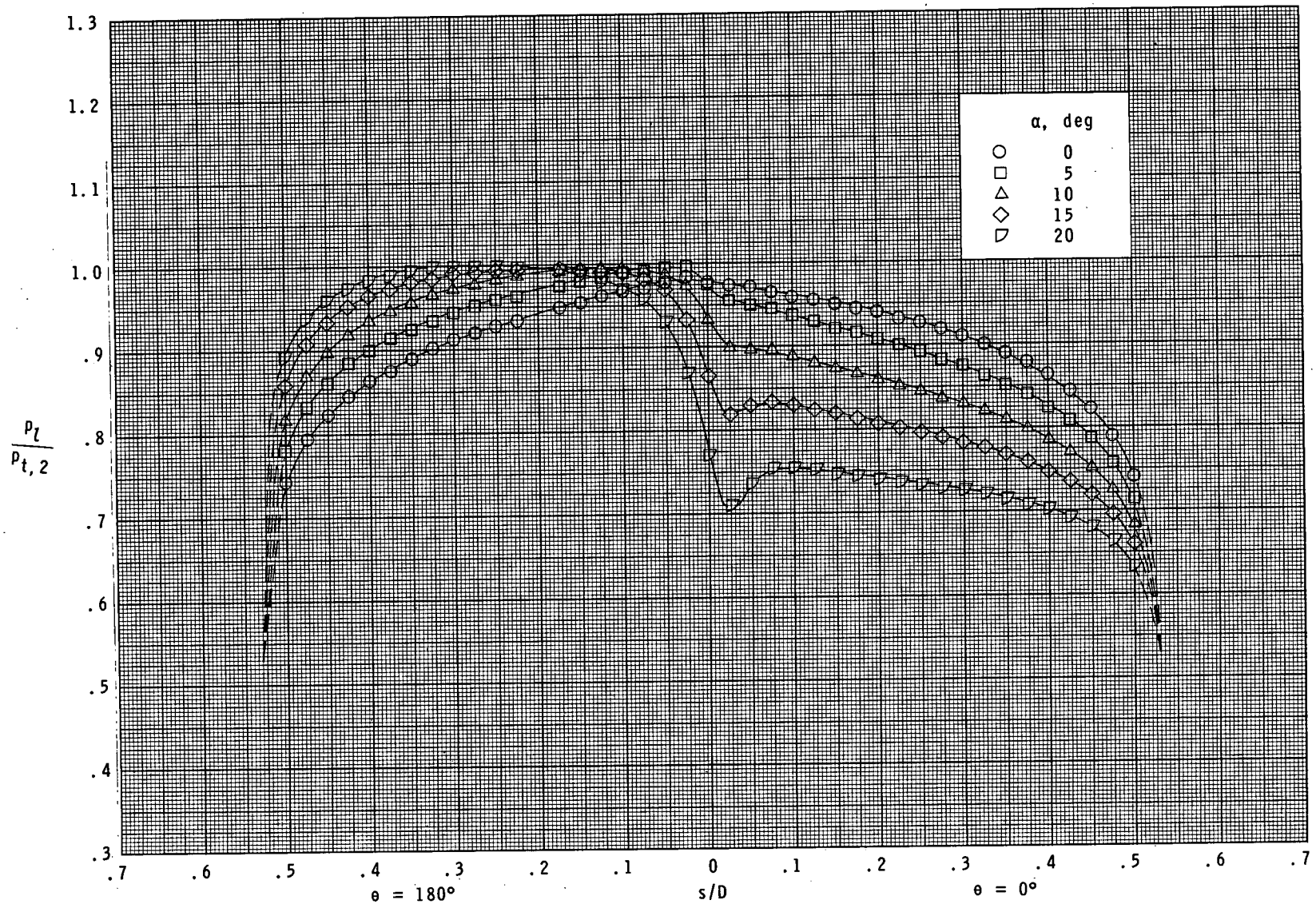
(a) $M_\infty = 2.30$.

Figure 4.- Effect of angle of attack on the pressure distributions of the 140° cone. $\Phi = 0.0°$.



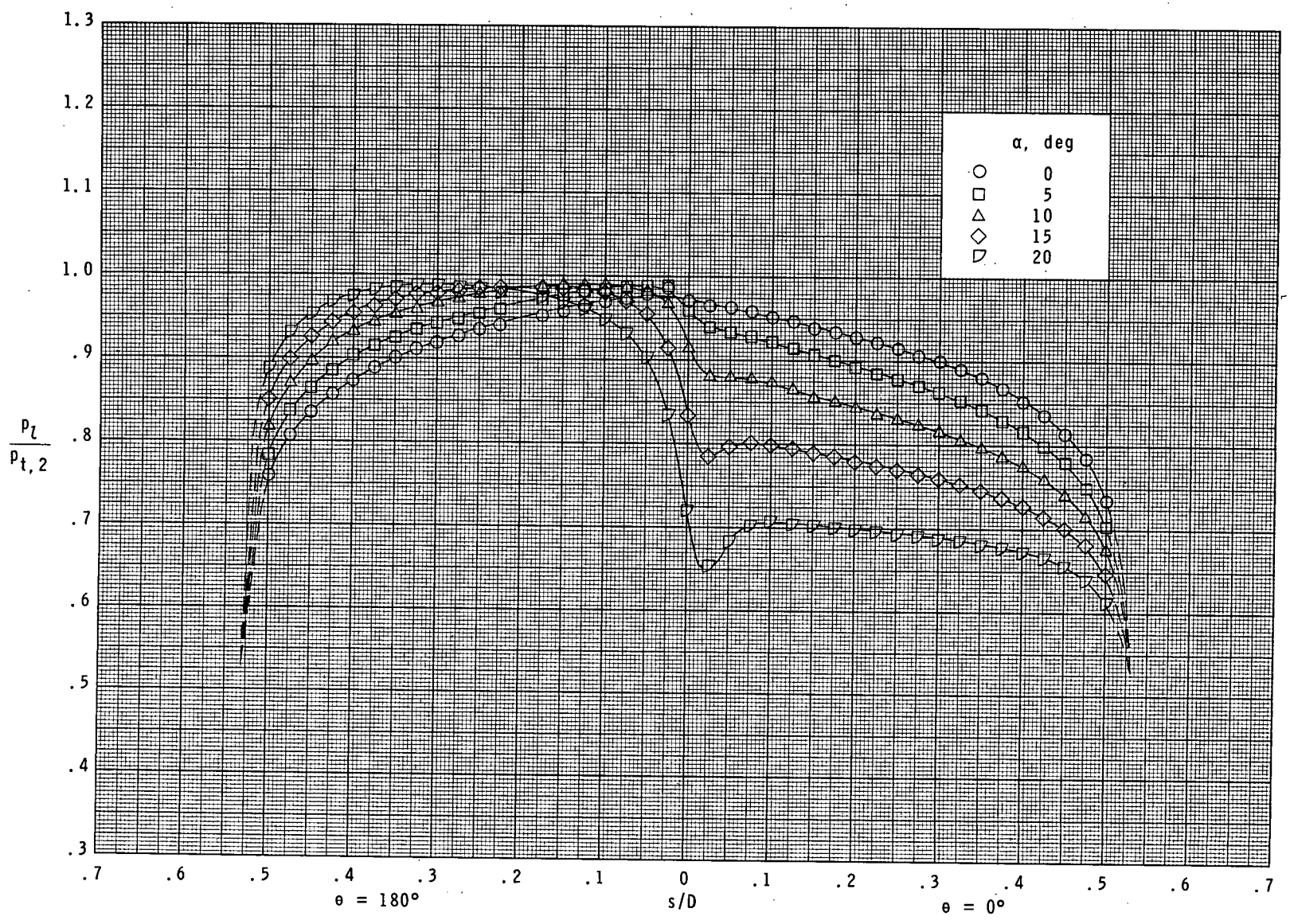
(b) $M_\infty = 2.96$.

Figure 4.- Continued.



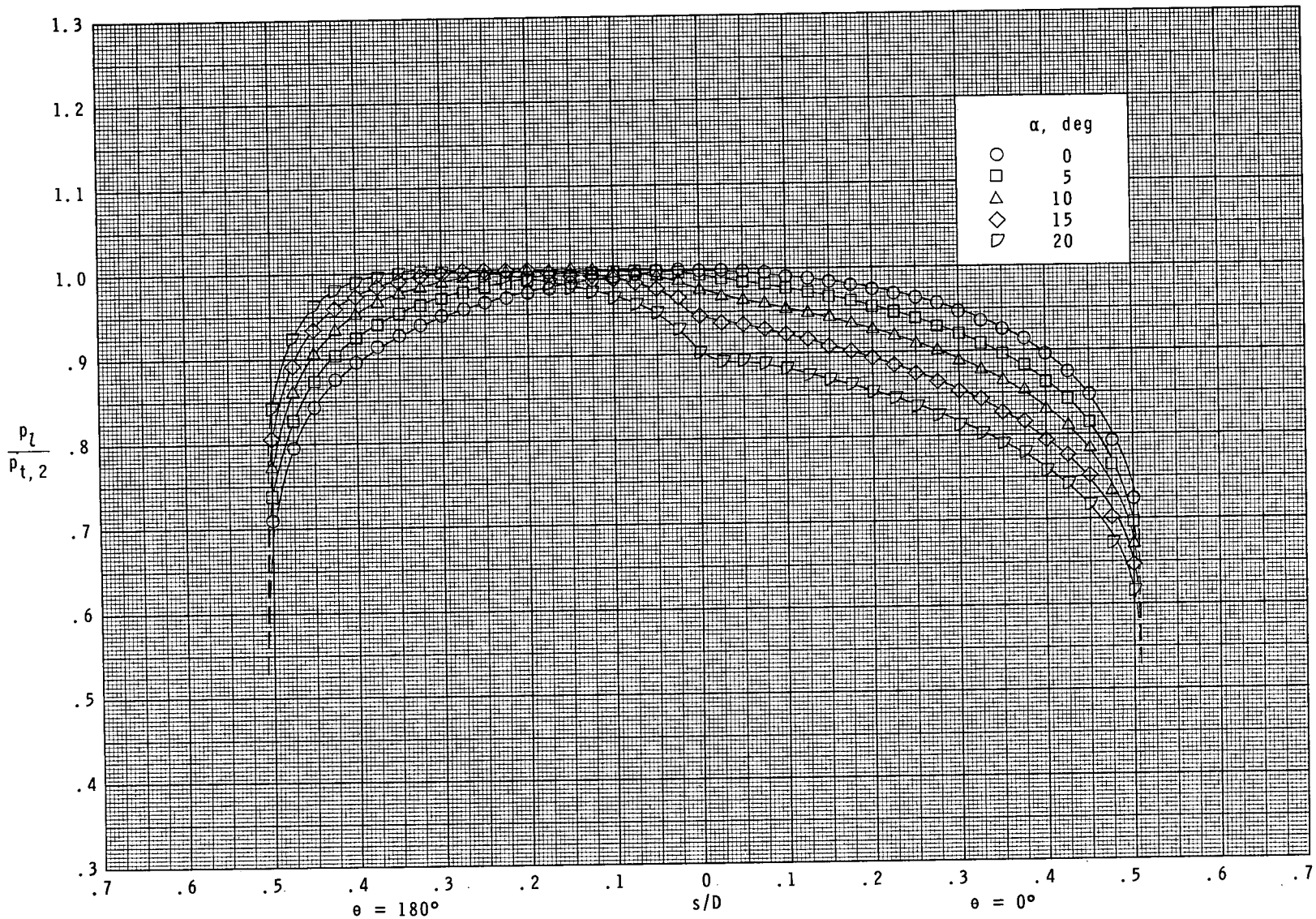
(c) $M_\infty = 3.95$.

Figure 4.- Continued.



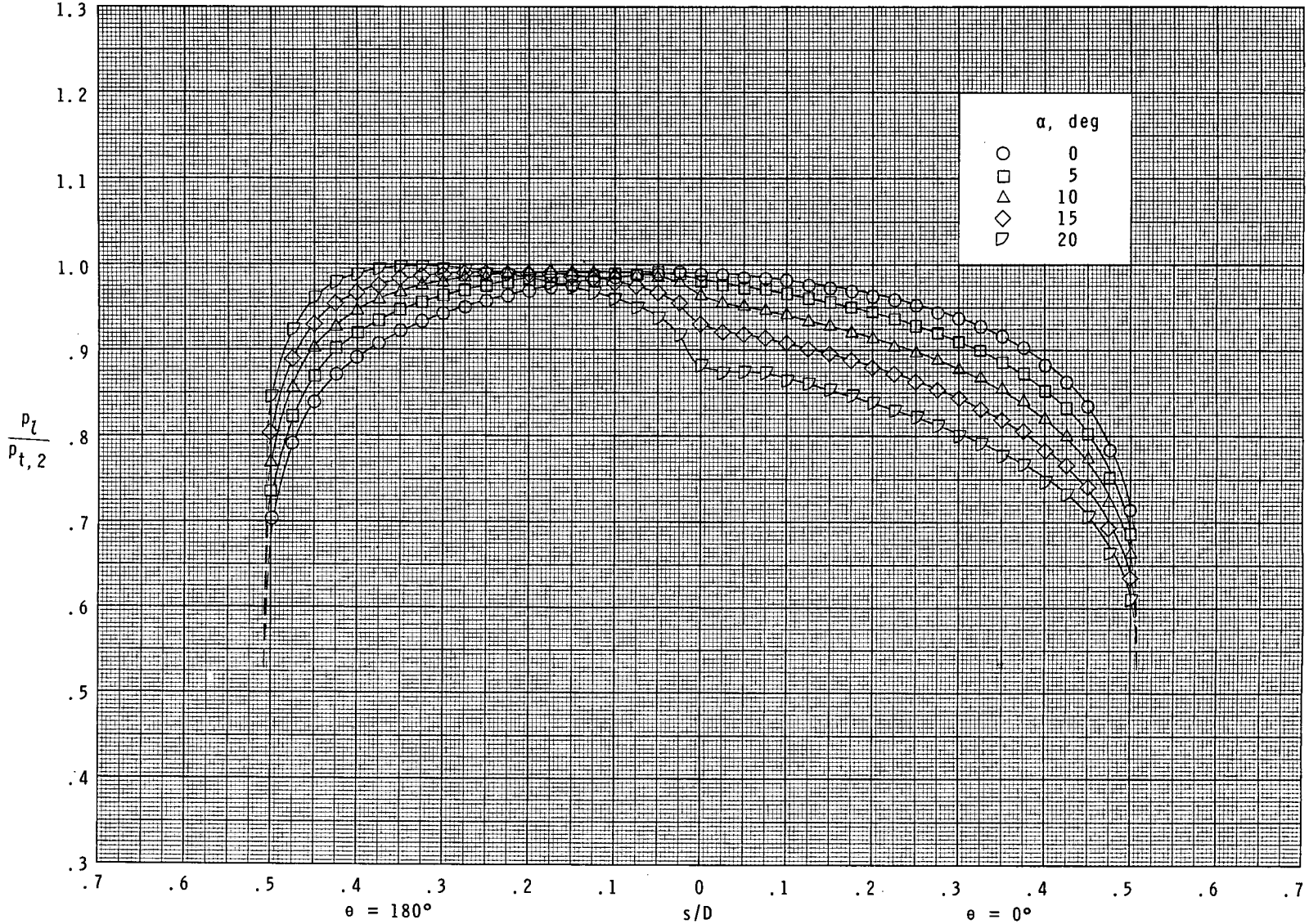
(d) $M_\infty = 4.63$.

Figure 4.- Concluded.



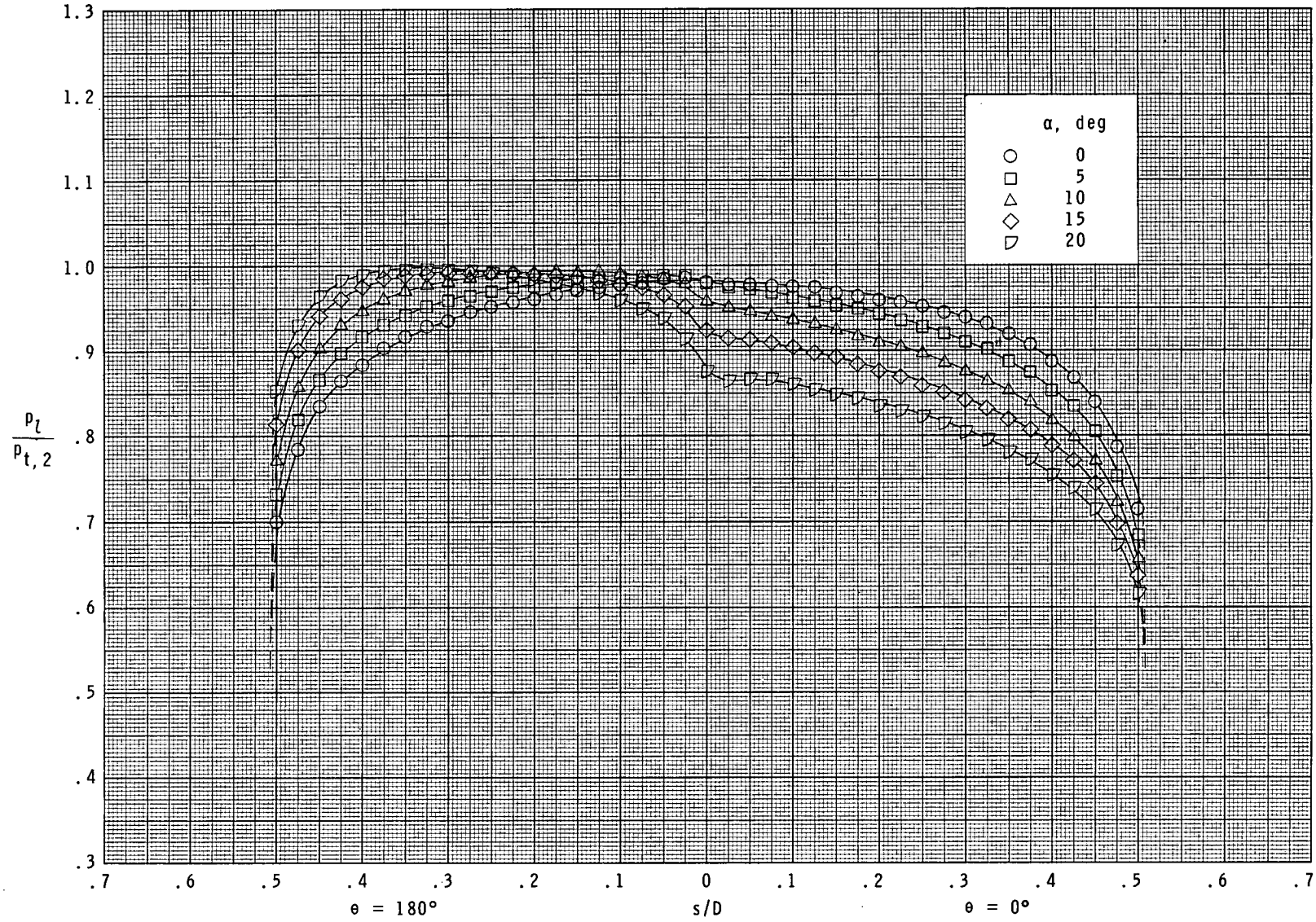
(a) $M_\infty = 2.30$.

Figure 5.- Effect of angle of attack on the pressure distributions of the 160° cone. $\Phi = 0.0°$.



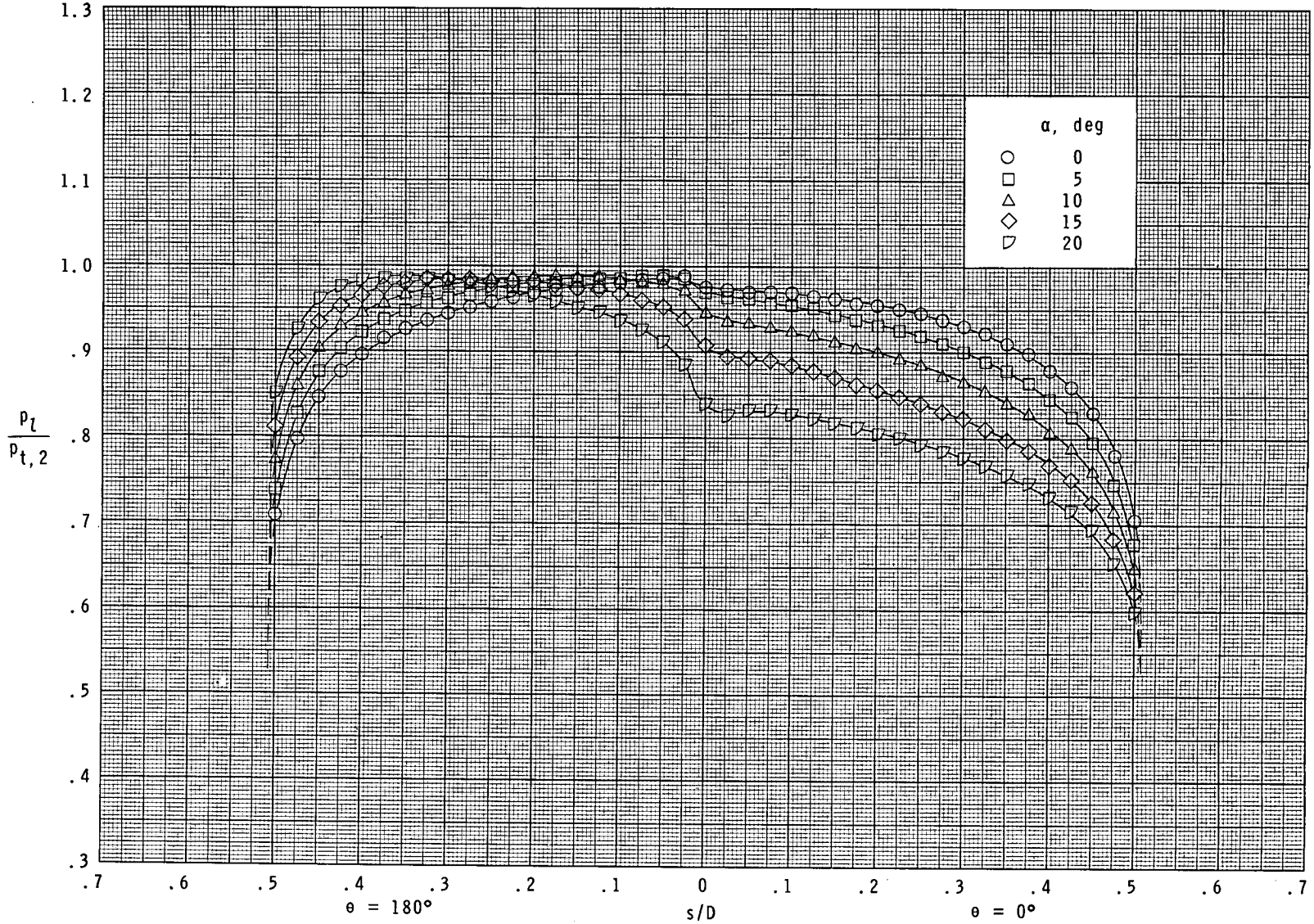
(b) $M_\infty = 2.96$.

Figure 5.- Continued.



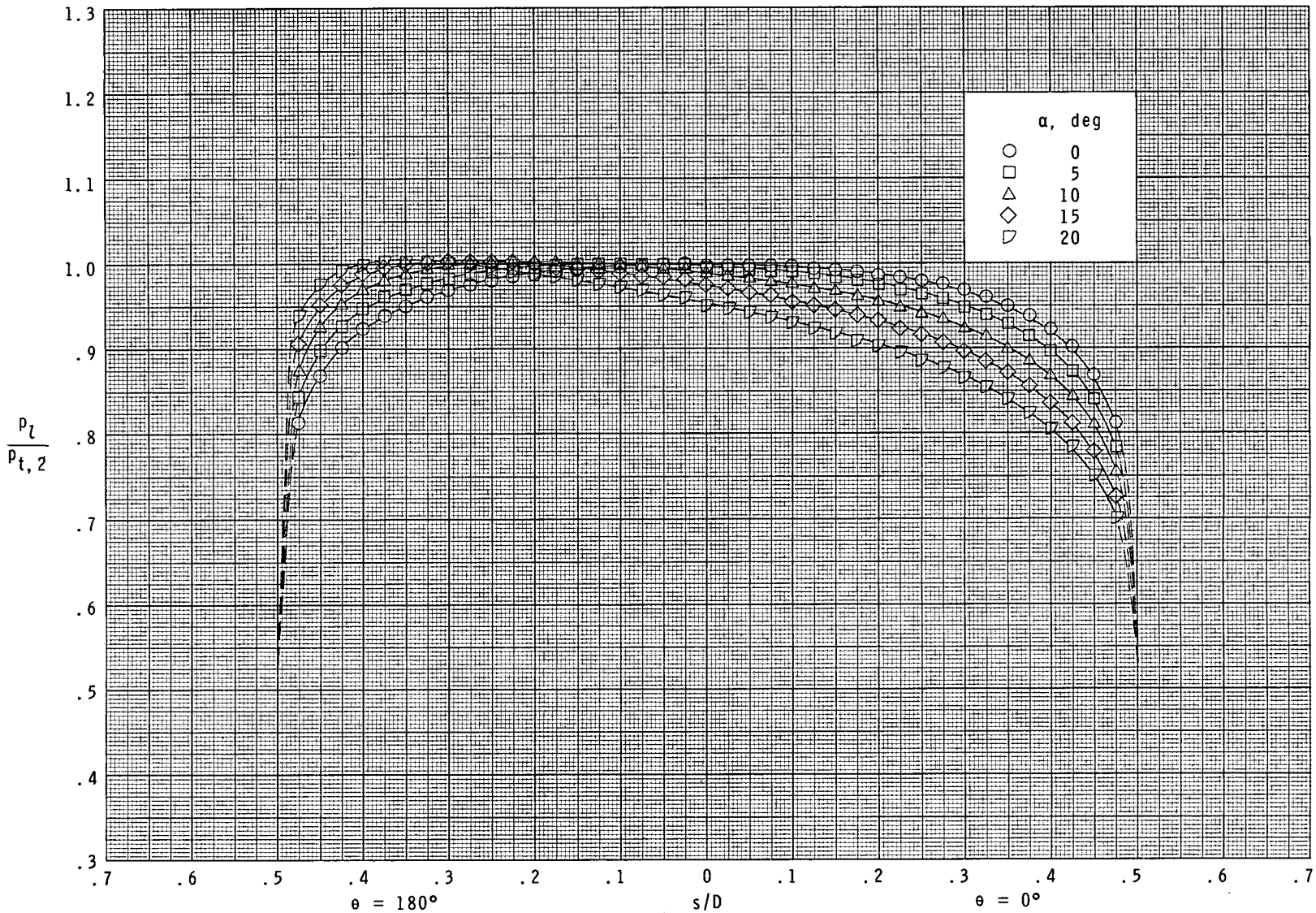
(c) $M_\infty = 3.95$.

Figure 5.- Continued.



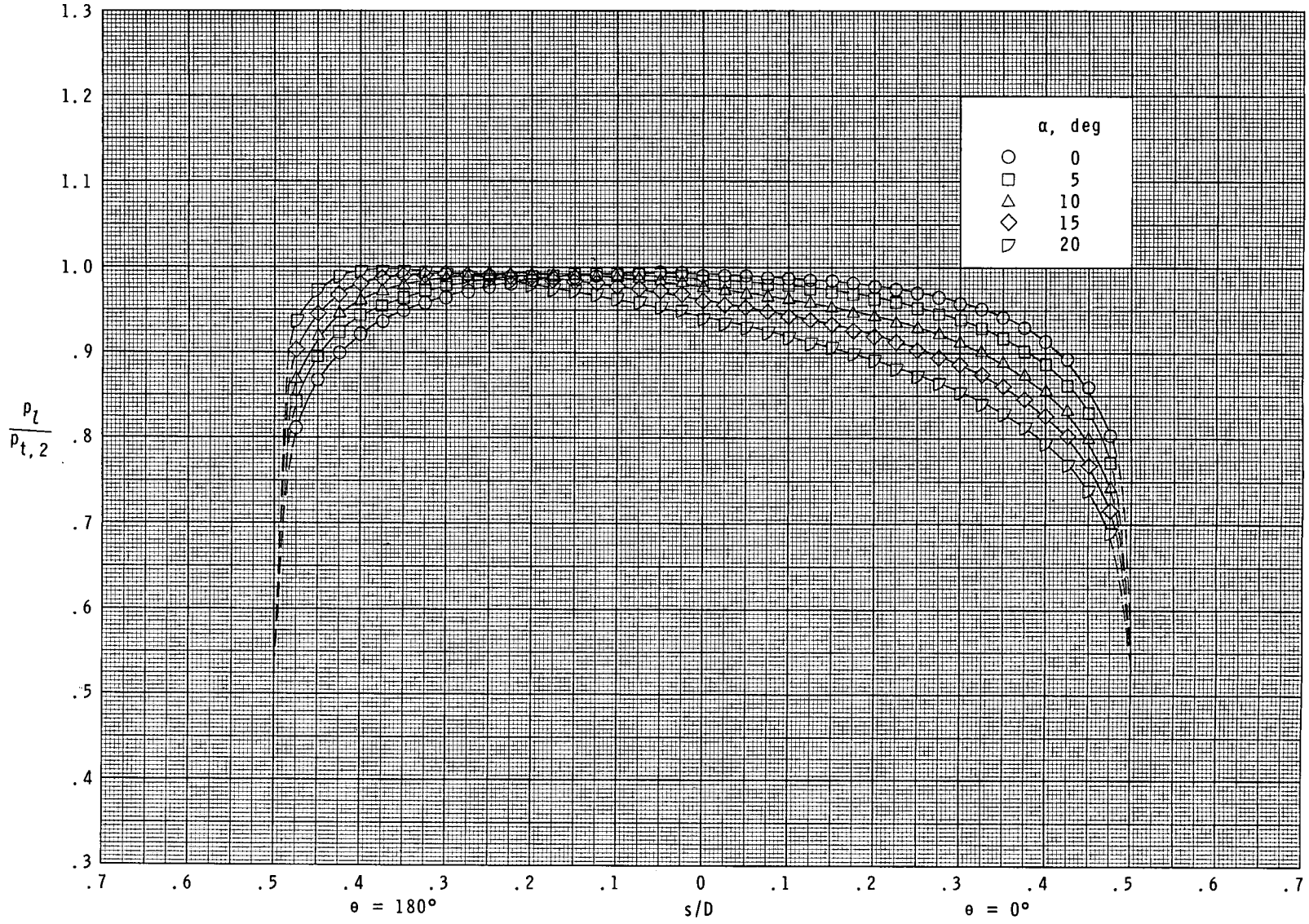
(d) $M_\infty = 4.63$.

Figure 5.- Concluded.



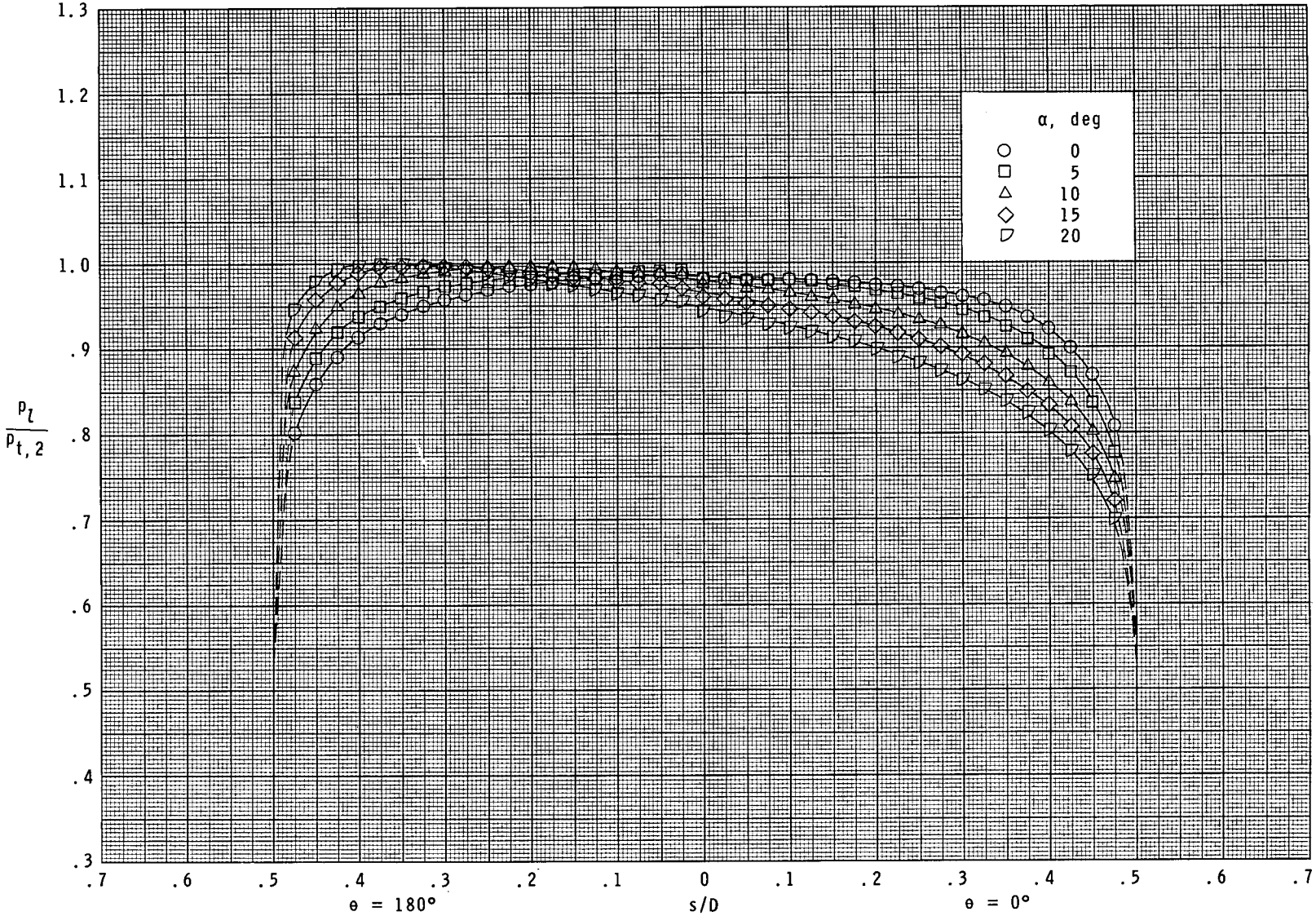
(a) $M_\infty = 2.30$.

Figure 6.- Effect of angle of attack on the pressure distributions of the 180^0 cone (flat disk). $\Phi = 0.0^0$.



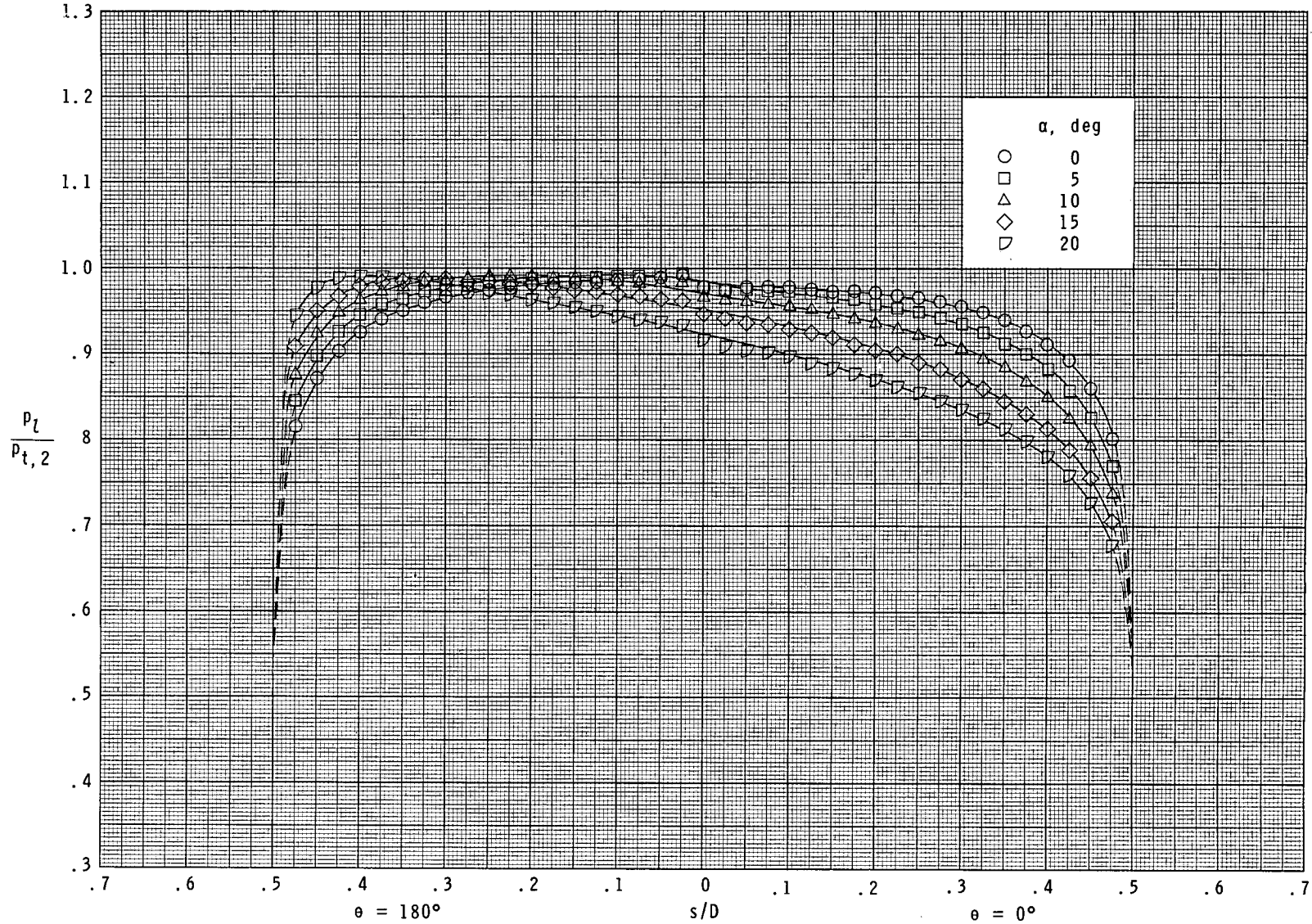
(b) $M_\infty = 2.96$.

Figure 6.- Continued.



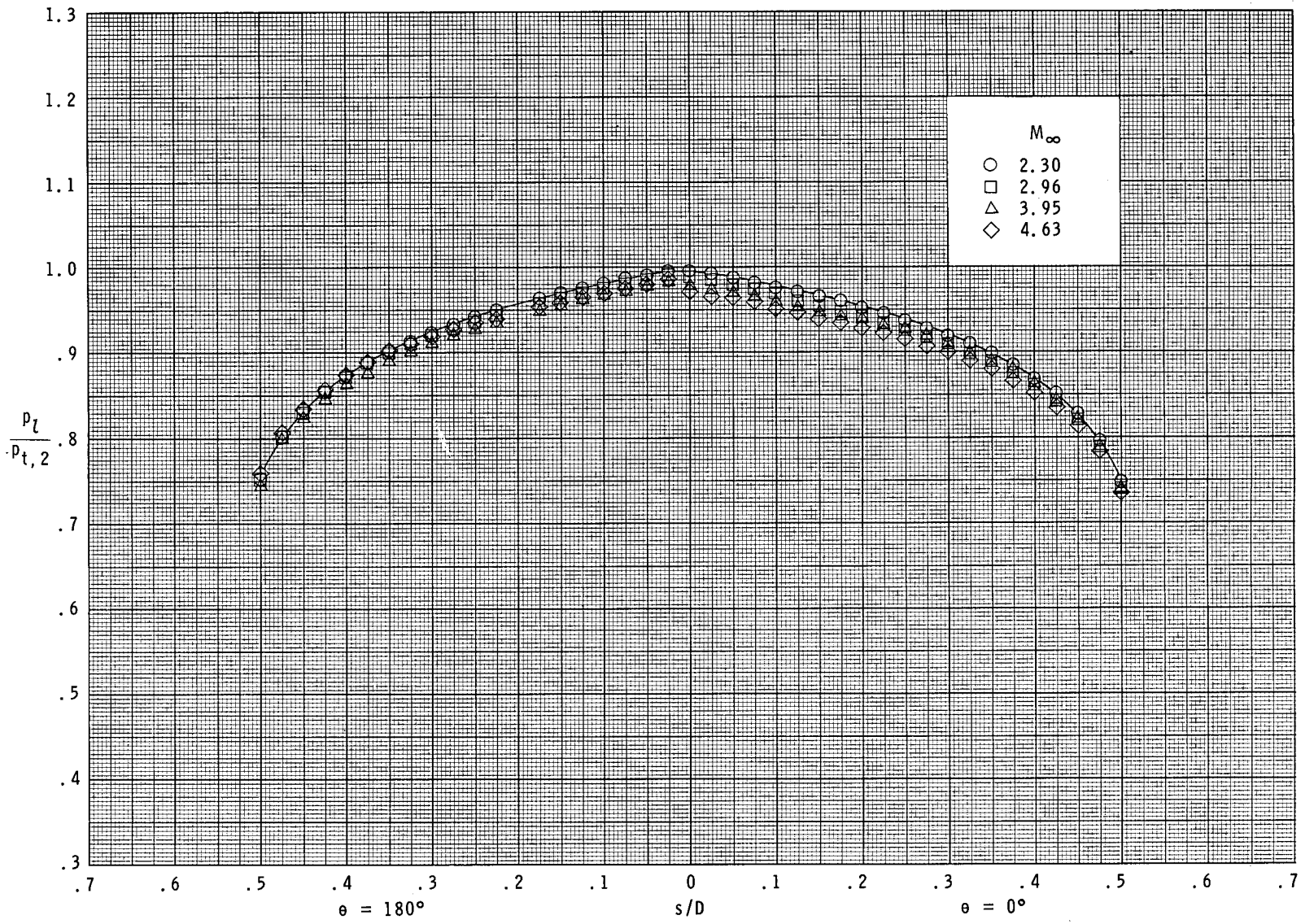
(c) $M_\infty = 3.95$.

Figure 6.- Continued.



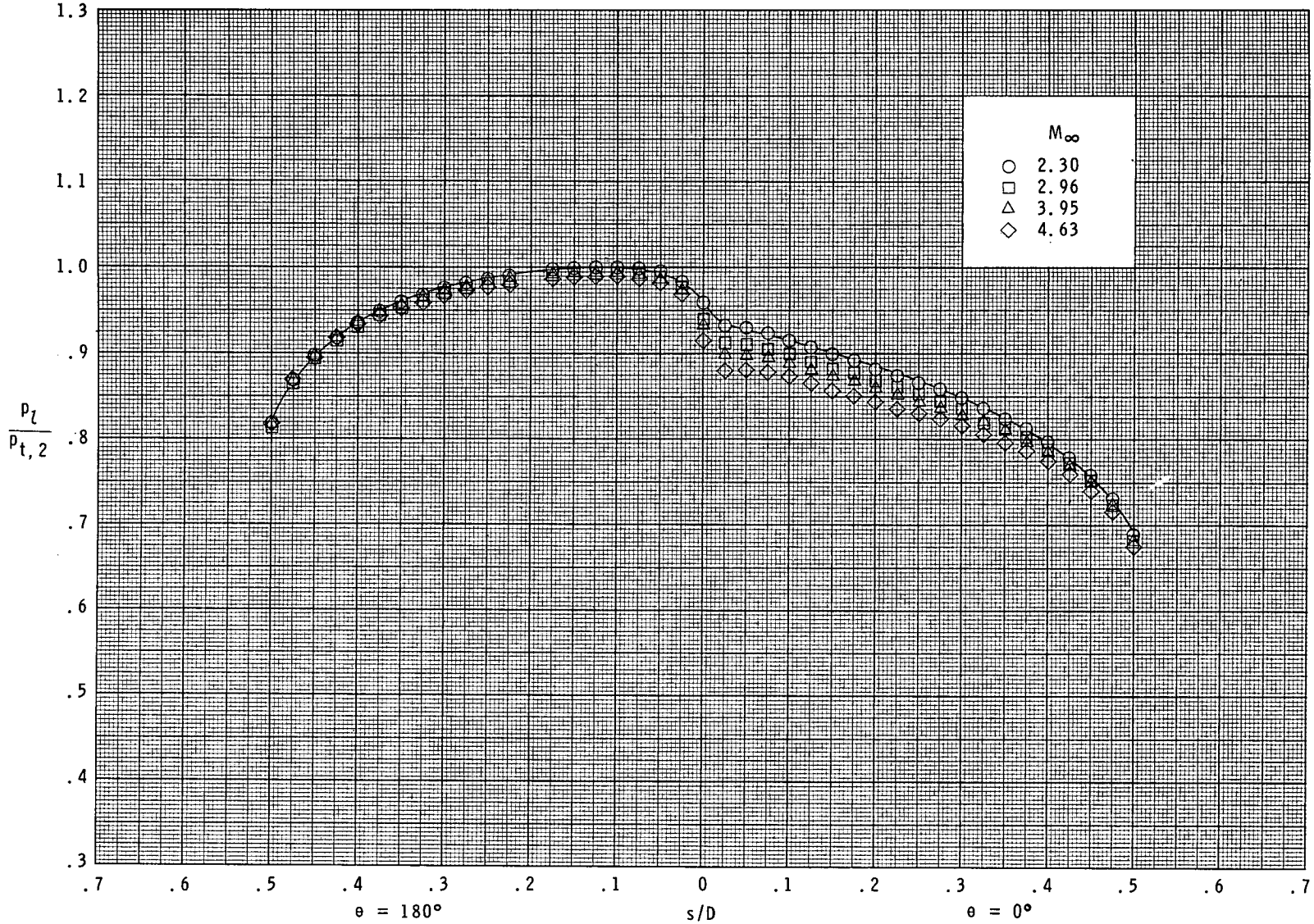
(d) $M_\infty = 4.63$.

Figure 6.- Concluded.



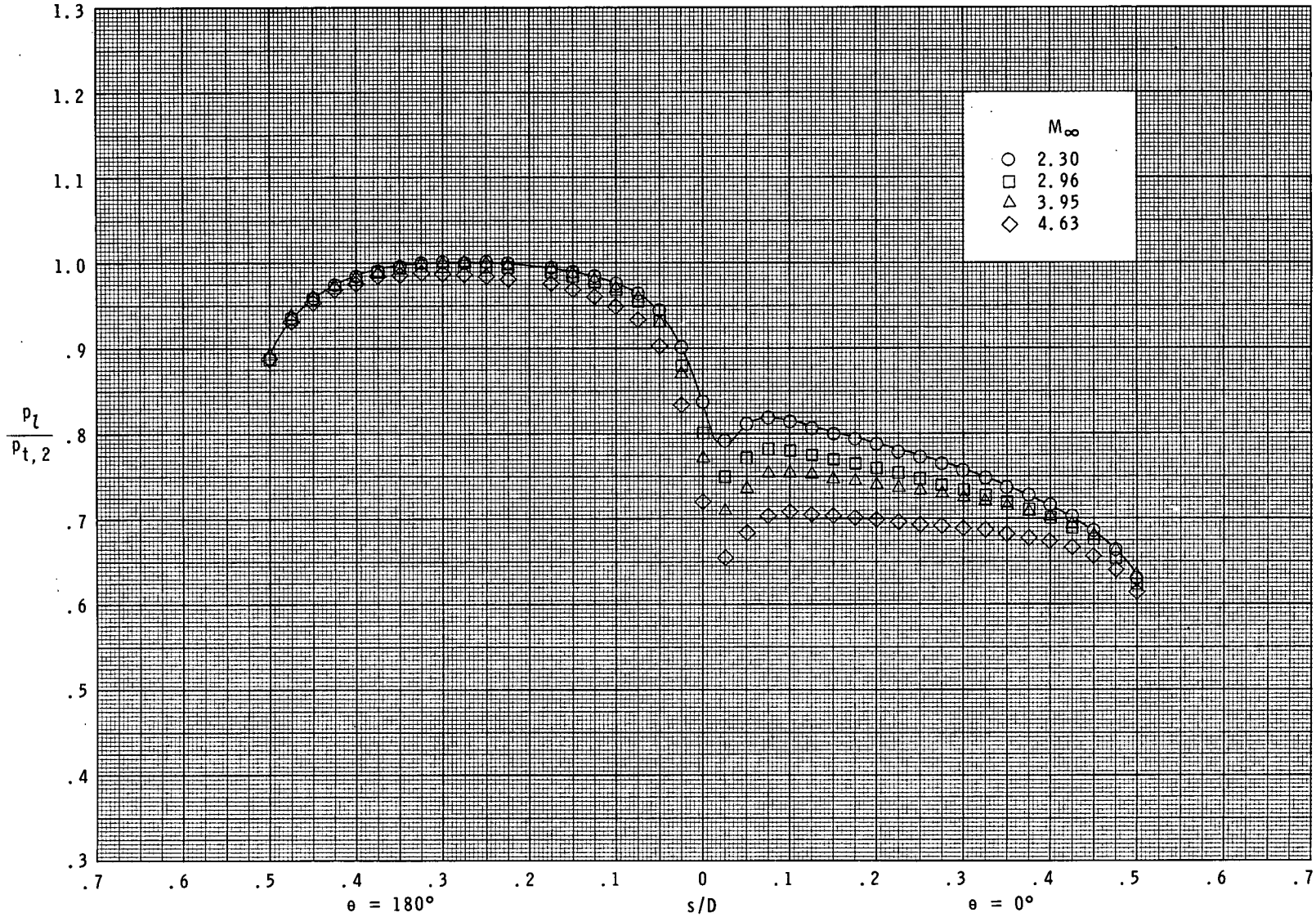
(a) $\alpha = 0^0$.

Figure 7.- Effect of Mach number on the pressure distributions of the 140^0 cone. $\Phi = 0.0^0$.



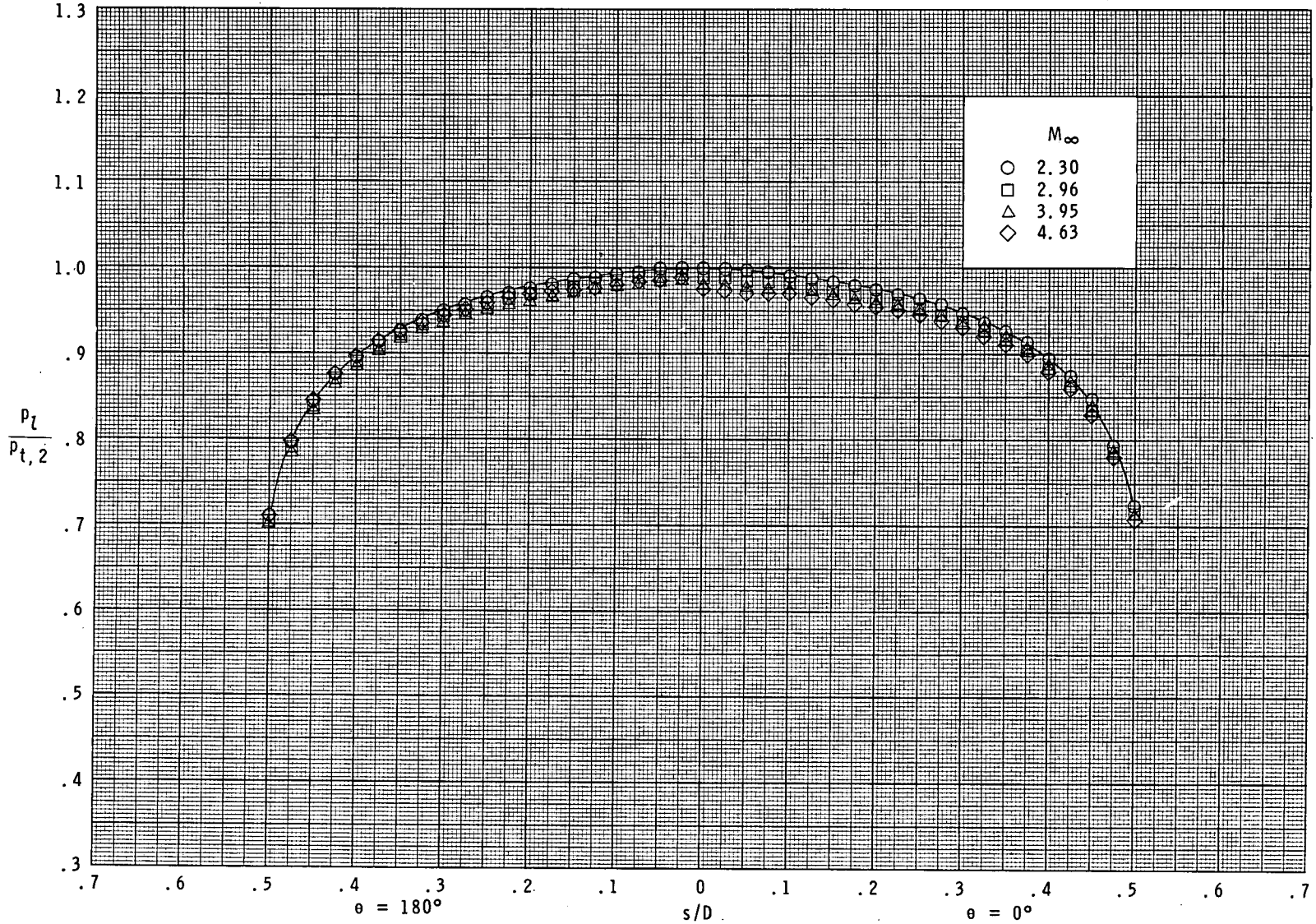
(b) $\alpha = 10^0$.

Figure 7.- Continued.



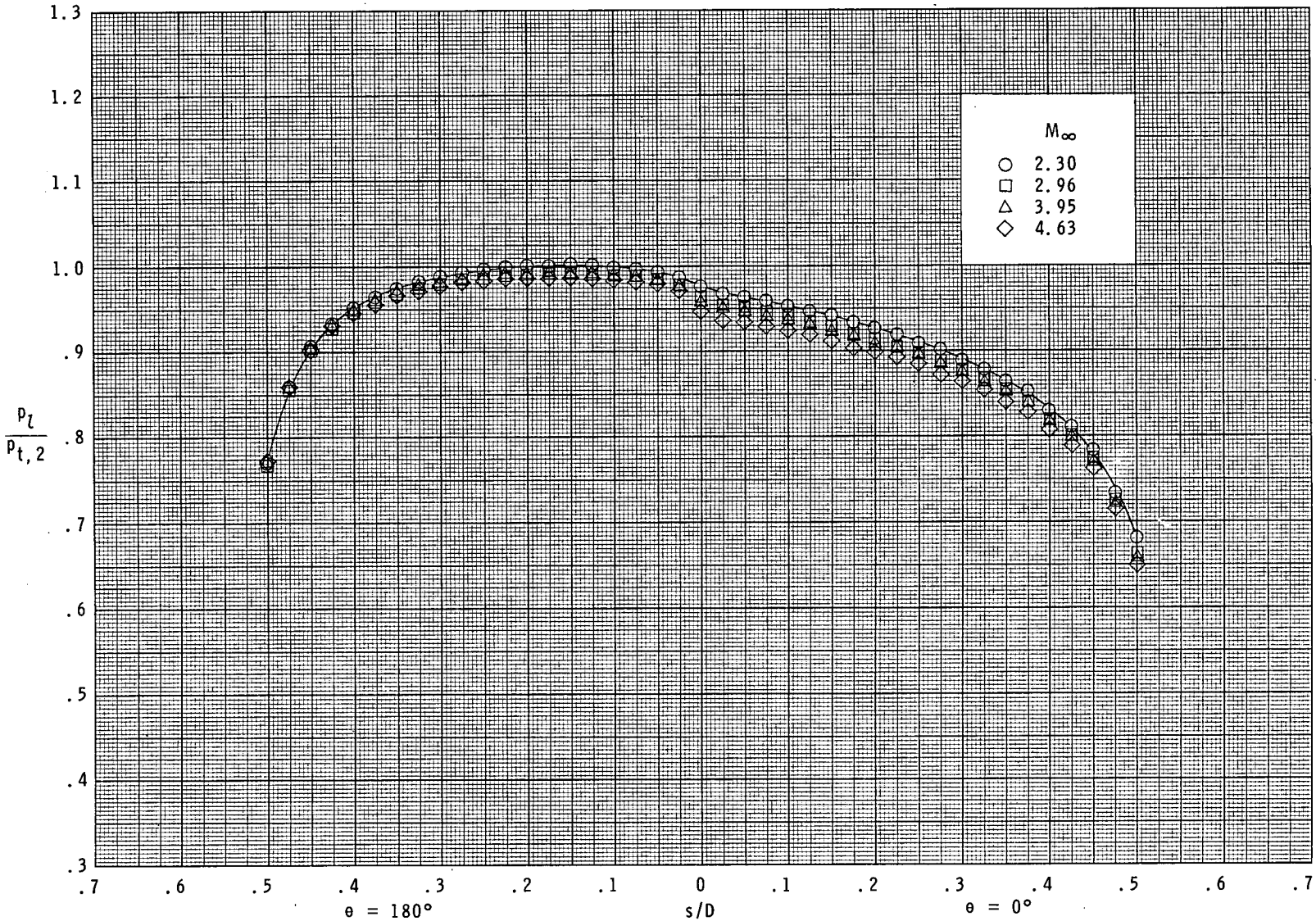
(c) $\alpha = 20^{o}$.

Figure 7.- Concluded.



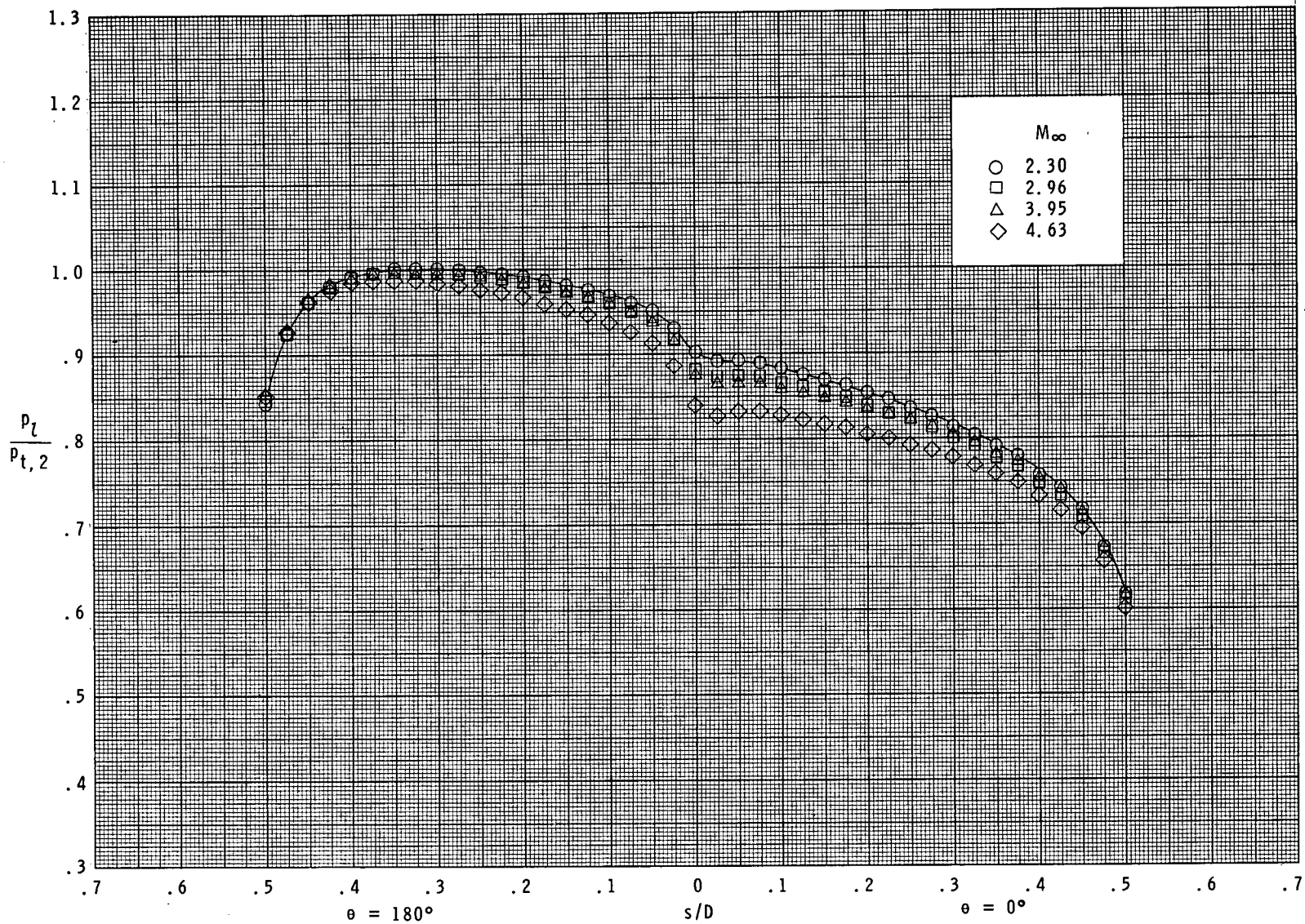
(a) $\alpha = 0^0$.

Figure 8.- Effect of Mach number on the pressure distributions of the 160^0 cone. $\Phi = 0.0^0$.



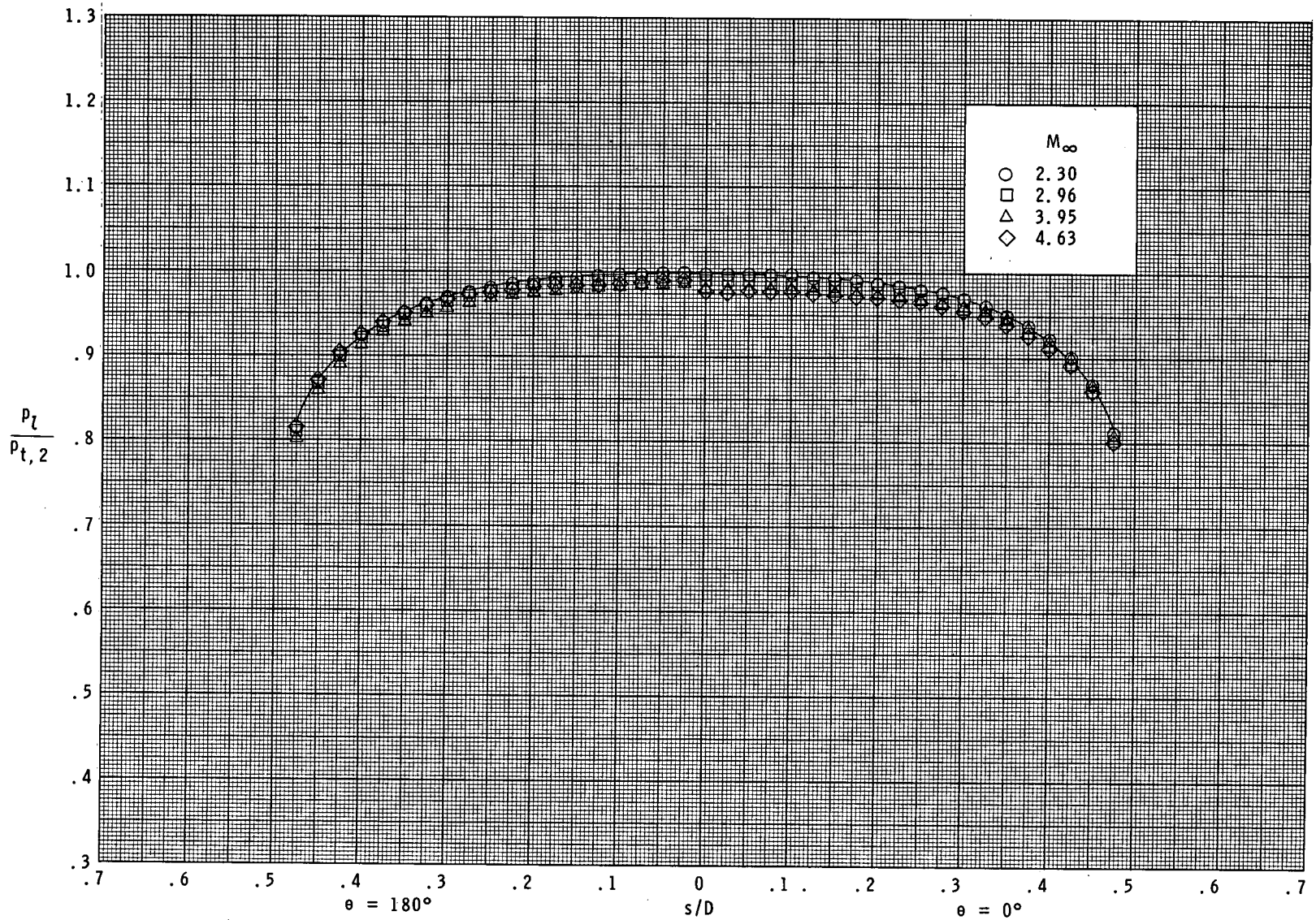
(b) $\alpha = 10^{o}$.

Figure 8.- Continued.



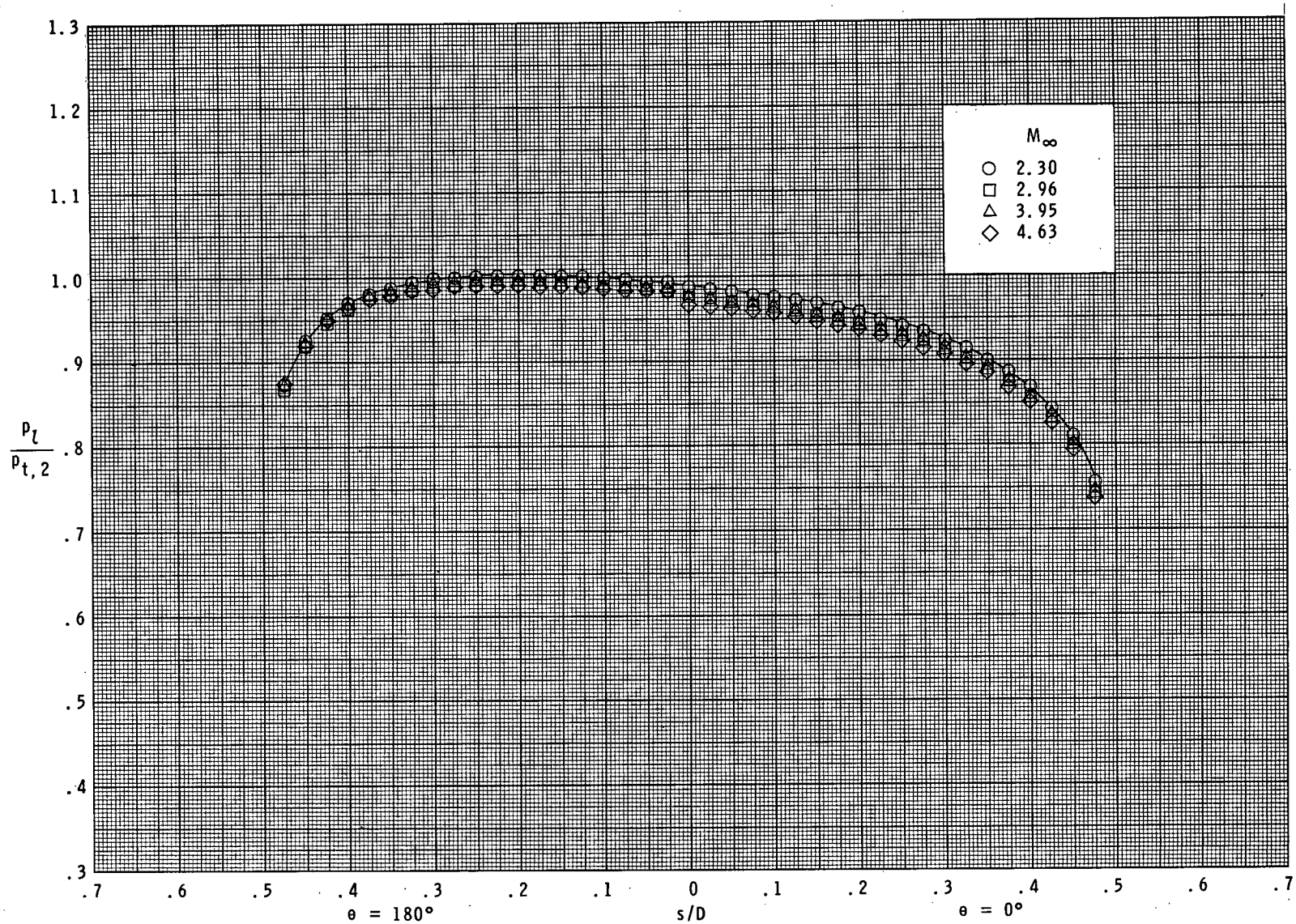
(c) $\alpha = 20^{\circ}$.

Figure 8.- Concluded.



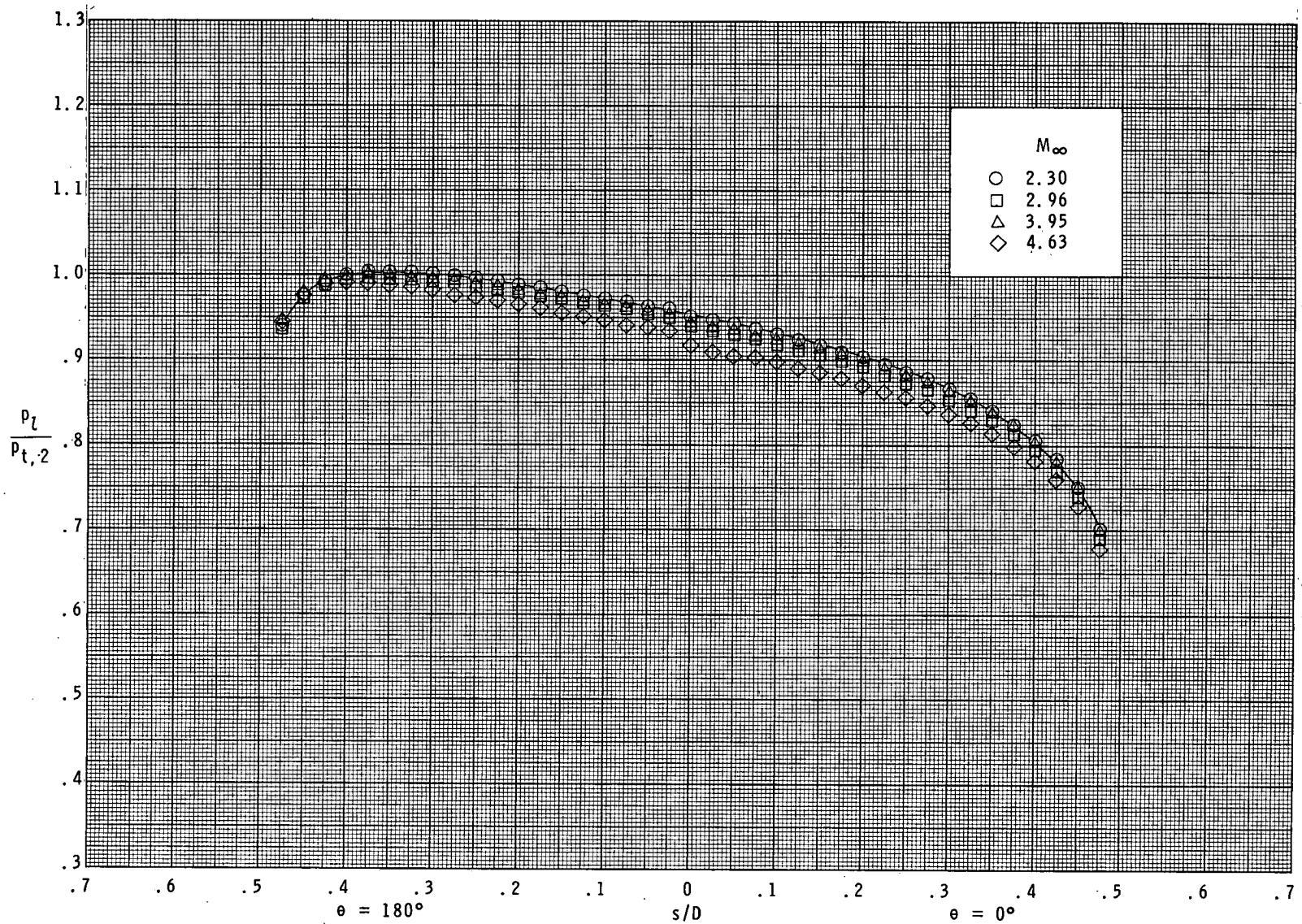
(a) $\alpha = 0^0$.

Figure 9.- Effect of Mach number on the pressure distributions of the 180^0 cone (flat disk). $\Phi = 0.0^0$.



(b) $\alpha = 10^0$.

Figure 9.- Continued.



(c) $\alpha = 20°$.

Figure 9.- Concluded.

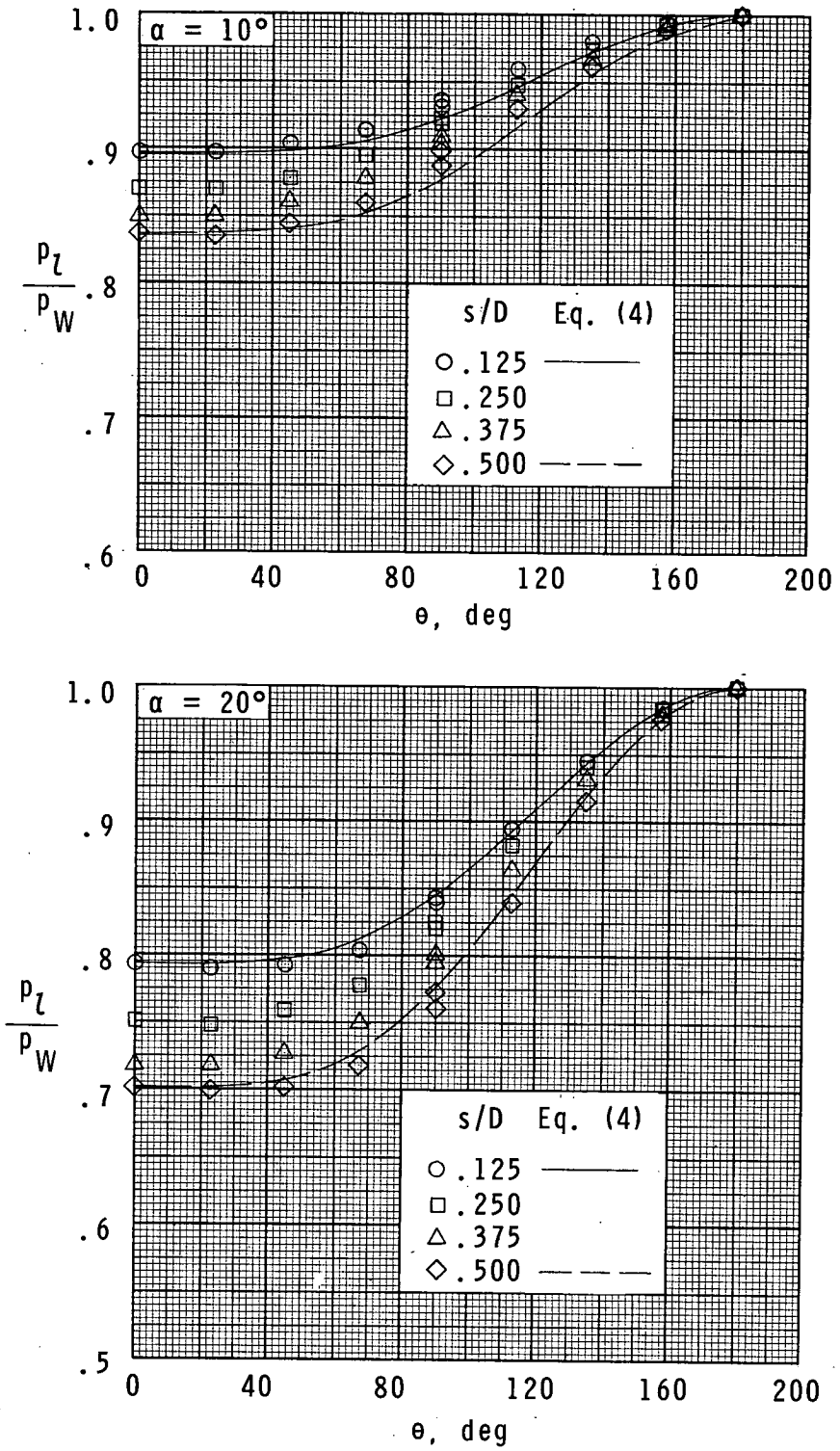


Figure 10.- Circumferential pressure distributions for the 140° cone at two angles of attack and $M_\infty = 2.96$.

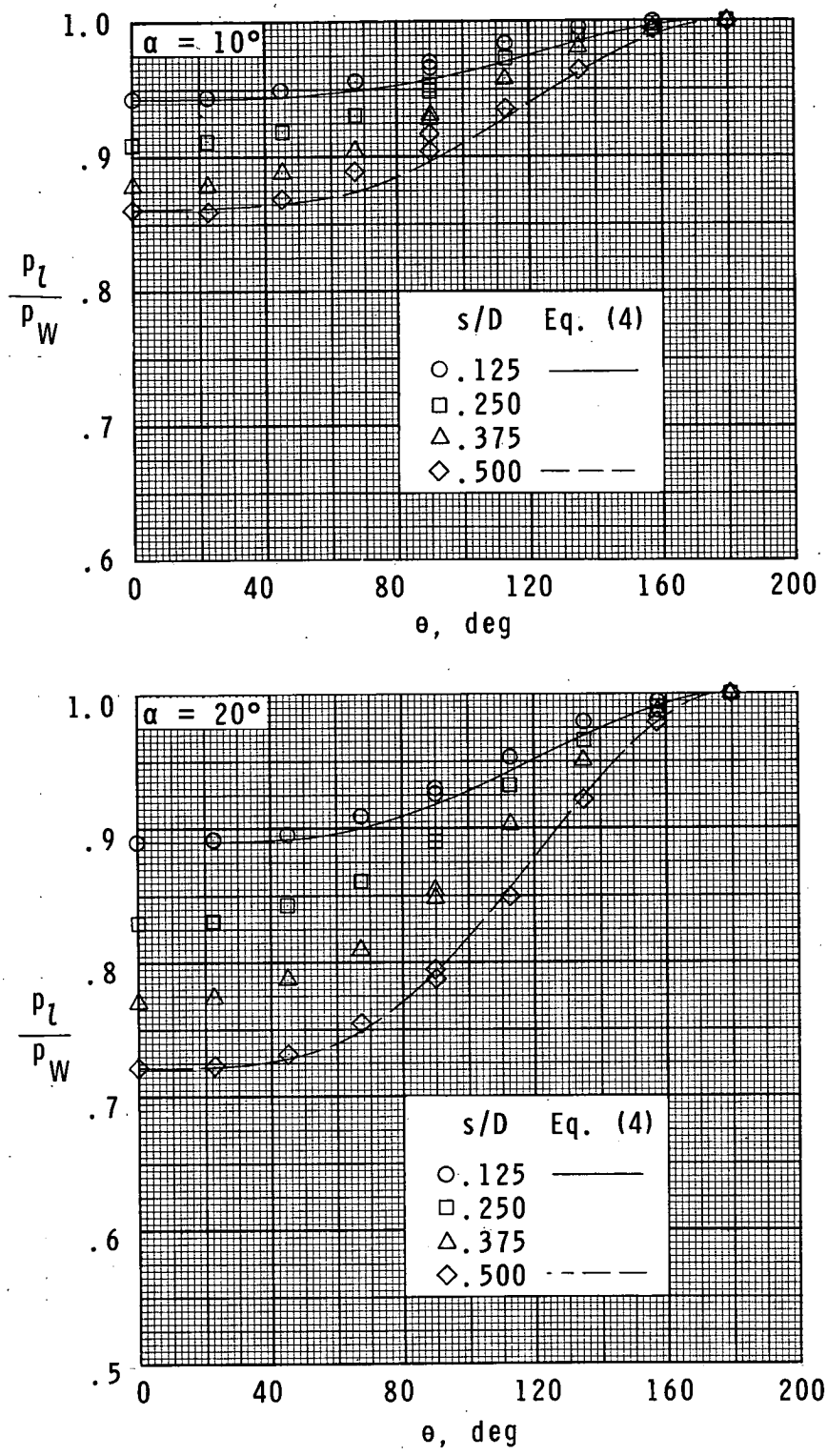


Figure 11.- Circumferential pressure distributions for the 160° cone at two angles of attack and $M_\infty = 2.96$.

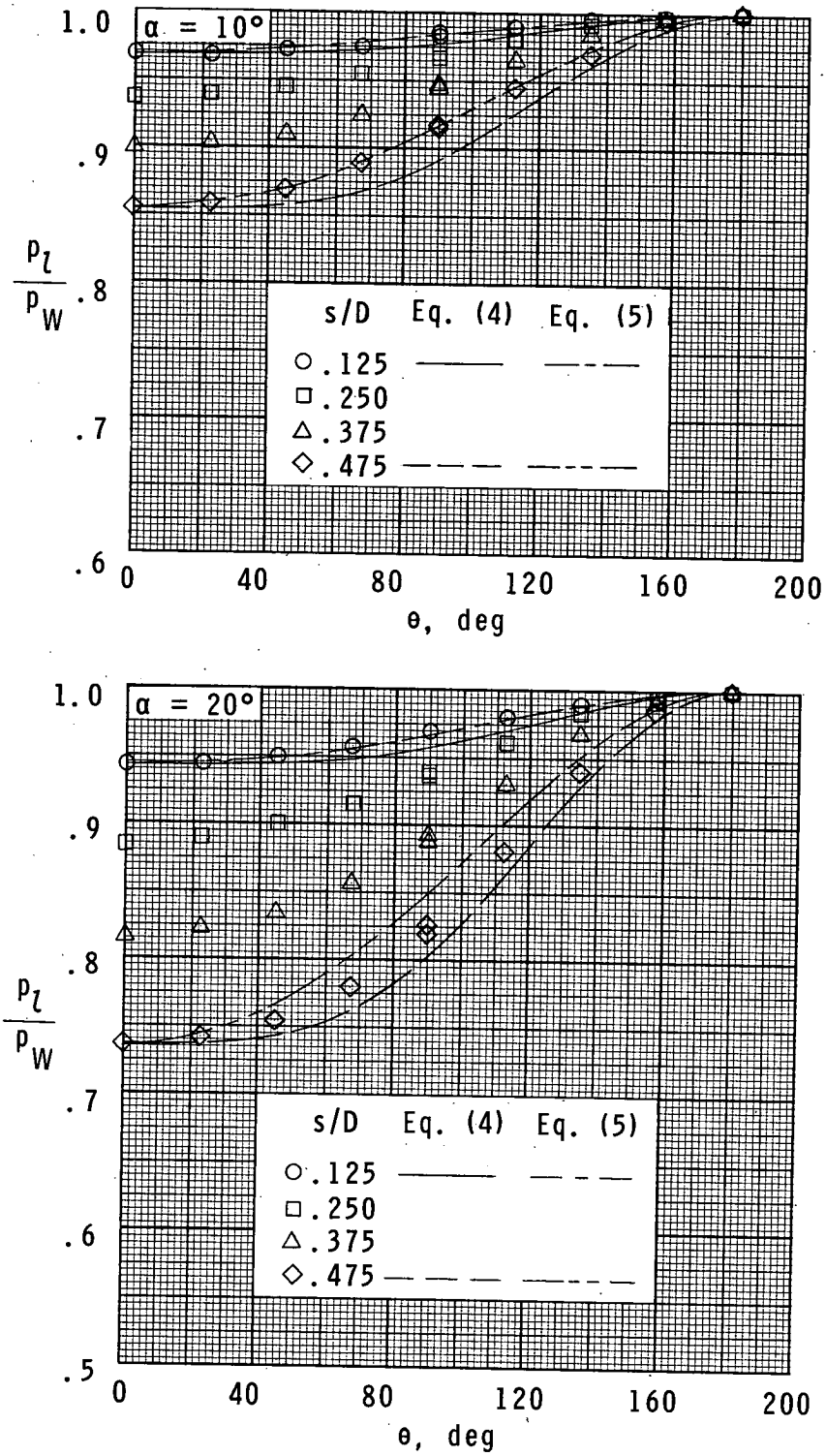


Figure 12.- Circumferential pressure distributions for the 180° cone (flat disk) at two angles of attack and $M_\infty = 2.96$.

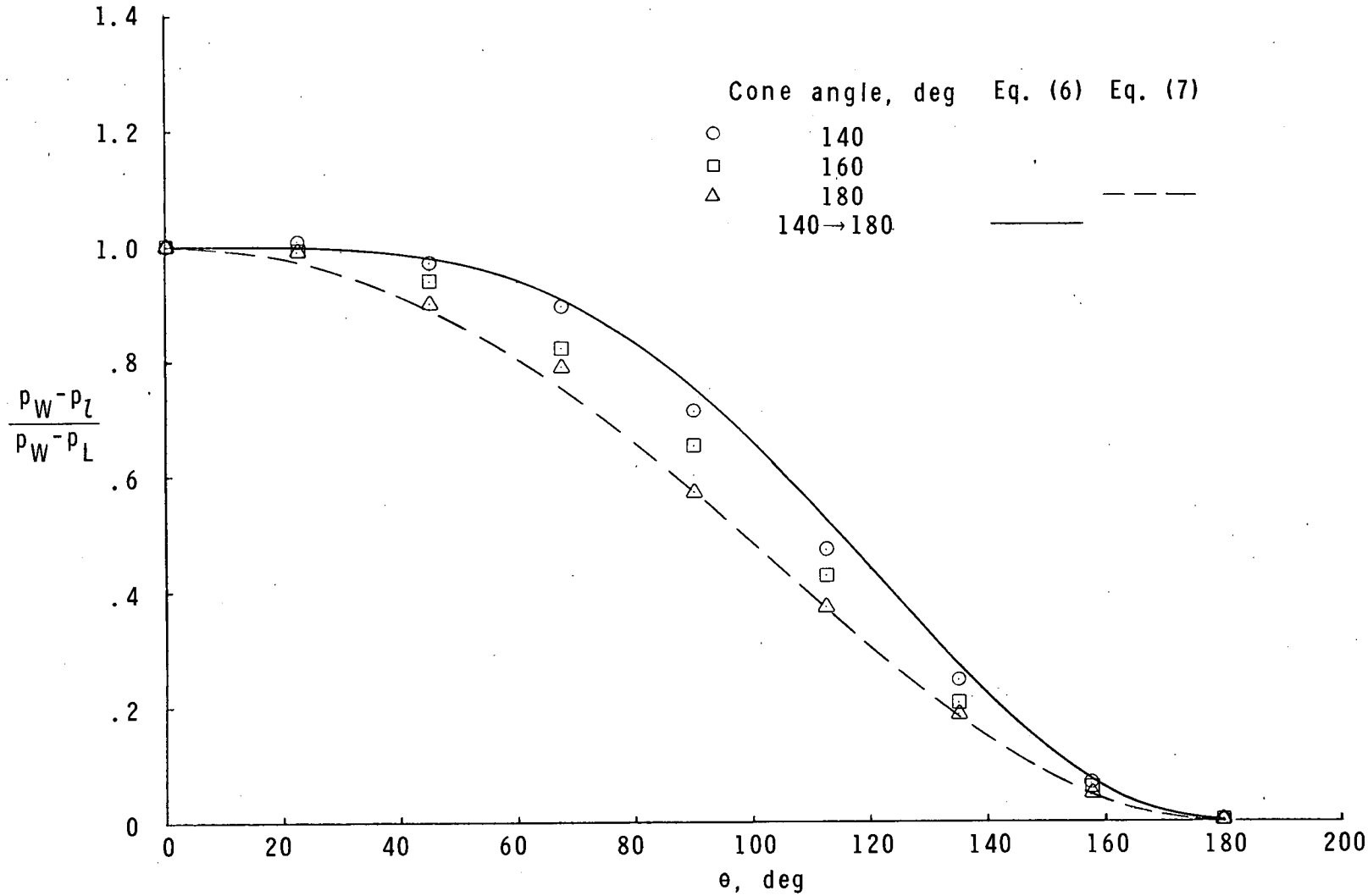


Figure 13.- Comparison of experimental and empirical circumferential pressure distributions for the 140°, 160°, and 180° cones at $M_\infty = 2.96$.

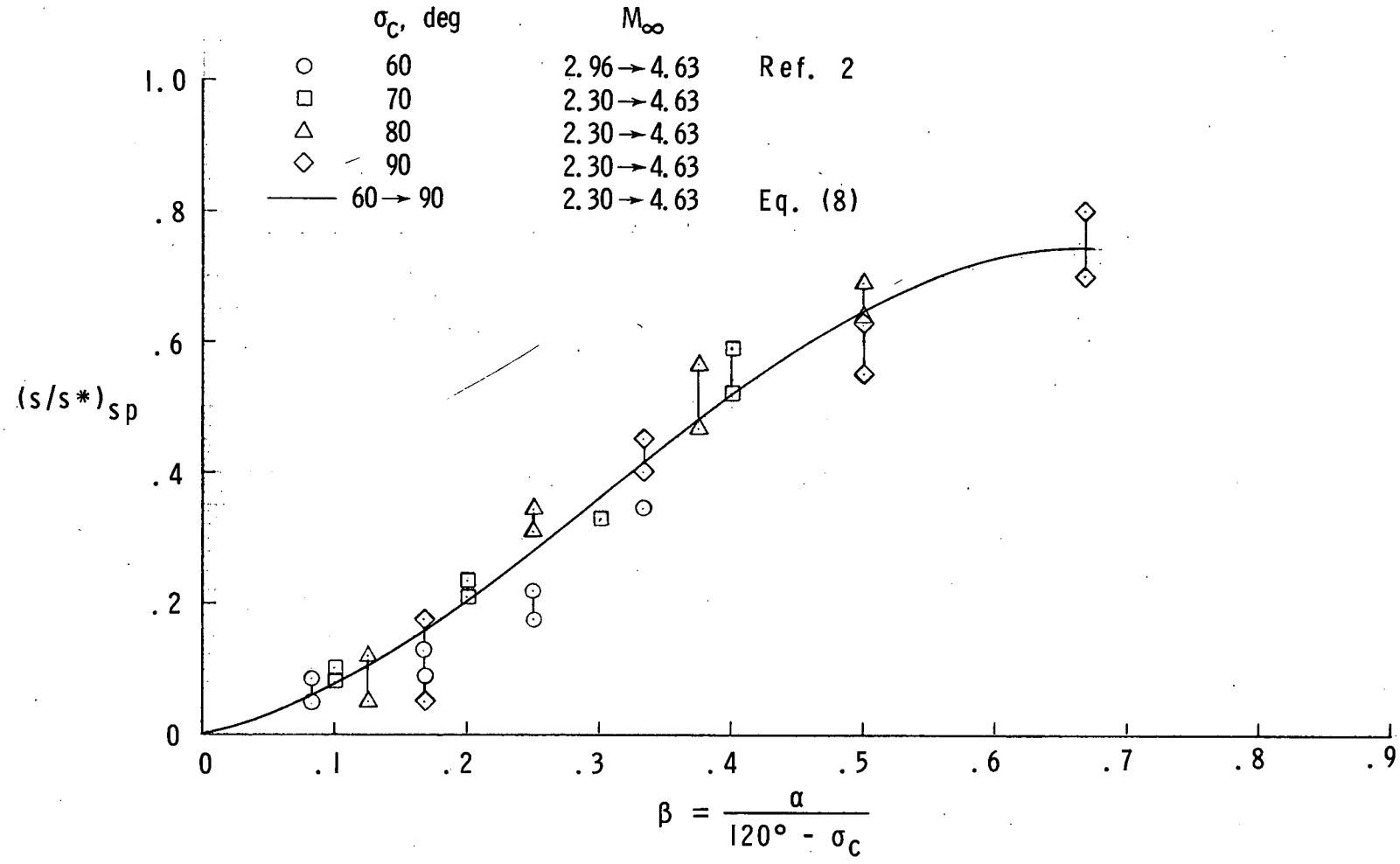


Figure 14.- Correlation of stagnation-point location for the cones at various angles of attack. (Connected symbols indicate maximum deviation within Mach number range.)

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